Program and Course Learning outcome of Undergraduate and Post Graduate course

Department of Anthropology

BIDHANNAGAR COLLEGE
SALT LAKE

INTRODUCTION

The B.Sc. Major in Anthropology under the NEP 2020 framework at West Bengal State University is a vibrant, interdisciplinary three- to four-year Major program—structured to provide rigorous academic grounding and immersive field-based experiences. Rooted in the three major branches—, Biological, Archaeological and Social-Cultural Anthropology—the curriculum spans foundational courses in Human variation, Population genetics, Human Evolution, Primatology, Forensic Anthropology, Prehistoric Archaeology and Palaeoanthropology, Culture studies & Social organization, of different tribal, rural and urban societies along with specialized areas such as Economic Anthropology, Political Anthropology, Anthropology of Religion, Ecology and finally Applied, Action and Development Anthropology. Anthropology uses a holistic methodology comprising of extensive laboratory based practical components, museum-based learning, and extensive fieldwork-based training from all the three aforesaid specialized branches. In its initial semesters, the course introduces students to the core concepts across all the branches, followed by advanced theoretical study and hands-on training in anthropometric measurements, archaeological fieldwork techniques, and fieldwork based ethnographic and applied research. The program places a strong emphasis on experiential learning—integrating field exploration, participant observation, and data collection under faculty mentorship—culminating in a major research or dissertation project in later semesters. Designed to develop critical thinking, cultural sensitivity, quantitative and qualitative research skills, and ethical scholarship, this learner-centric curriculum meets NEP 2020's goals of flexibility and interdisciplinarity by offering minor electives, environmental awareness courses, and skill enhancement opportunities. Graduates emerge equipped for a wide array of careers in academia, research institutes, non-government organizations, Cultural Heritage management, public policy, development agencies, and social advocacy, as well as advanced study in anthropology and related social sciences.

The M.Sc. course in Anthropology at Bidhannagar College was introduced in 2019 under the Choice Based Credit System (CBCS). It is designed to provide students with a comprehensive understanding of the discipline by integrating the three core branches: Biological, Archaeological, and Social-Cultural Anthropology. The program emphasizes both theoretical and practical learning, fostering a holistic perspective through advanced coursework, laboratory training, museum visits and intensive research-oriented fieldwork and finally specialized dissertation work. In the first two semesters, all the PG students continue common core papers from all the branches of Anthropology but in the final two semesters students opt for specialization in any one branch either Biological Anthropology or Archaeological Anthropology or Social Cultural Anthropology. Students gain expertise in diverse areas from the different branches in Anthropology such as Anthropometry, Forensic Anthropology, Anthropology of health, tribal studies, Urban Anthropology, Ecological Anthropology and Archaeological research methodologies particularly field-based exploration. Upon completion, the post-graduates are equipped not only for academic and research careers including progression to Ph.D. and postdoctoral studies but also for roles get engaged in teaching, public administration, and development sectors, as the curriculum instills a strong sense of social responsibility and practical skills for community engagement. The course outcomes ensure that students develop critical analytical abilities, methodological proficiency, and an appreciation for the application of anthropological knowledge in real-world contexts, ultimately preparing them for meaningful contributions in academia, policy-making, and social welfare.

UNDER GRADUATE PROGRAMME OUTCOME AND COURSE OUTCOME

COURSE OFFERED

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

Progamme Outcomes	
PO 1	Students should acquire knowledge about the different concepts in Anthropology a holistic way.
PO 2	Students should undertake Laboratory Practical and fieldwork-oriented activities and develop practical knowledge and skills on qualitative and quantitative analysis and case study formulation required for perusing career in different specialized areas in Anthropology
PO 3	Recognize, appreciate and practice Anthropological knowledge and its application in academic, administrative, Environmental, various social and developmental context.

Programme Specific Outcomes	
PSO 1	To demonstrate a fundamental or coherent understanding of Anthropology, its different learning areas and applications, and its linkages with related disciplinary areas/subjects
PSO 2	To use holistic knowledge encompassing the biological and social-cultural attributes, in understanding and identifying problems and issues,
PSO 3	To construct the critical thinking skill
PSO 4	Collection of relevant quantitative and/or qualitative data from wide range of sources.
PSO 5	Application, analysis and evaluation using methodologies as appropriate for formulating evidence-based solutions and arguments.
PSO 6	Skill to communicate the results of studies undertaken in an academic field accurately in a range of different contexts using the main concepts.
PSO 7	Skill to apply one’s disciplinary knowledge and skills to new/unfamiliar contexts, rather than replicate curriculum content knowledge.
PSO 8	Skill to identify and analyze problems and issues and solve complex problems with well-defined solutions.
PSO 9	To demonstrate subject-related skills those are relevant to some of the job trades, entrepreneurship, and employment opportunities.
PSO 10	Skill to integrate concepts from multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Anthropology.
PSO 11	To develop communicative skills and human values

PROGRAMME SPECIFIC OUTCOME AND COURSE OUTCOME MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
DS-1	Y	Y		Y	Y	Y					
DS-2	Y	Y		Y	Y	Y					
DS-3	Y	Y				Y					
DS-4	Y	Y	Y	Y	Y	Y					
DS-5	Y	Y				Y					
DS-6	Y	Y		Y	Y	Y			Y		
DS-7	Y	Y	Y	Y	Y	Y	Y	Y	Y		
DS-8	Y	Y	Y	Y	Y	Y					
DS-9	Y	Y	Y	Y	Y	Y					
DS-10	Y	Y	Y	Y	Y	Y			Y		
DS-11	Y	Y	Y	Y	Y	Y			Y		
DS-12	Y	Y	Y			Y					
DS-13	Y	Y	Y	Y	Y	Y					
DS-14	Y	Y	Y	Y	Y	Y					
DS-15	Y	Y	Y	Y	Y	Y					
DS-16	Y	Y	Y	Y	Y	Y					
DS-17	Y	Y	Y	Y	Y	Y			Y		
DS-18	Y	Y	Y	Y	Y	Y	Y		Y		
DS-19	Y	Y	Y	Y	Y	Y	Y				
DS-20	Y	Y	Y	Y	Y	Y	Y				
DS-21	Y	Y	Y	Y	Y	Y	Y	Y	Y		
MA-1/MB-1										Y	
MA-2/MB-2										Y	
MA-3/MB-3										Y	
SM1/SM2										Y	
SE-1	Y	Y	Y	Y	Y				Y		
SE-2	Y	Y	Y	Y	Y				Y		
SE-3										Y	
MD-1/MD-2/ MD-3										Y	
AE-1											Y
AE-2											Y
AE-3											Y
VA-1											Y
VA-2											Y

COURSE LEARNING OUTCOME

DISCIPLINE SPECIFIC COURSE (DSC)

DS-1
ANTDSC101T & ANTDSC101P
INTRODUCTION TO ANTHROPOLOGY –I

Course Outcomes:

1. **Comprehensive Understanding of Anthropology**: Students will be able to define anthropology, articulate its historical development from both global and Indian perspectives, and explain key concepts such as holism, cultural relativism, and the importance of cross-cultural comparison and fieldwork.
2. **Biological Anthropology Insights**: Students will demonstrate knowledge of human evolution, including the biological and cultural factors that influence it, and will be able to discuss the principles of evolution and the classification and characteristics of living primates, highlighting their evolutionary trends and socio-ecological contexts.
3. **Archaeological Methodology and Cultural Stages**: Students will understand the methods and approaches in archaeological anthropology, including exploration, excavation, and dating techniques, and will be able to outline the cultural stages of prehistory, including identifying and describing various stone and bone tools from these periods.
4. **Social and Cultural Dynamics**: Students will be equipped to analyze fundamental concepts of social and cultural anthropology, such as social structure, kinship, and marriage systems, and will be able to critically assess how these elements shape societies and cultural identities across different contexts.
5. **Skeletal Identification Proficiency**: Students will demonstrate the ability to accurately identify and describe the human skeleton's features, including cranial and postcranial bones, and will apply anatomical knowledge to determine sex from skeletal remains, focusing on specific bones such as the skull and pelvic girdle.
6. **Anthropoid Skull Analysis**: Students will develop skills in identifying and comparing the skulls of various anthropoid species, including Gibbons, Orangutans, Gorillas, and Chimpanzees, utilizing models or photographs to enhance their understanding of anatomical differences and evolutionary significance.
7. **Tool Typology and Functionality**: Students will be able to classify and analyze various prehistoric tools by identifying their typotechnological attributes, understanding their cultural contexts, and illustrating the methods of hafting and tool function, while effectively drawing and labelling tools from different prehistoric periods.

DS-2
ANTDSC202T & ANTDSC202P
INTRODUCTION TO ANTHROPOLOGY – II

Course Outcomes:

1. **Understanding Hominid Evolution**: Students will be able to describe the phylogenetic status, characteristics, and geographical distribution of key hominid species, from Tertiary hominoids to anatomically modern Homo sapiens, highlighting their evolutionary significance and adaptation.
2. **Human Variation and Genetics**: Students will demonstrate an understanding of the biological basis of human variation, including Mendelian inheritance and racial classifications, and will be able to critically analyze the implications of race and racism in contemporary society based on

genetic and morphological data.

3. **Economic Anthropology Framework**: Students will explore the meaning, scope, and relevance of economic anthropology, identify different means of subsistence, and understand the principles governing production, distribution, and exchange within various cultural contexts.
4. **Political and Religious Organization**: Students will be able to define and differentiate between various forms of political organization (band, tribe, chiefdom, state) and understand key concepts related to power, authority, and legitimacy. Additionally, they will analyze anthropological approaches to religion, recognizing different belief systems and the roles of religious specialists in various cultures.
5. **Identification and Classification of Extinct Hominids**: Students will demonstrate the ability to accurately identify and classify key extinct hominid species, such as Australopithecus africanus and Homo sapiens neanderthalensis, through the examination of casts, models, or photographs, highlighting their morphological features and evolutionary significance.
6. **Anthroposcopic Assessment Skills**: Students will develop skills in anthroposcopy by performing detailed observations of physical traits in human participants, including assessments of skin color, hair type, and ear characteristics, enabling them to understand human variation and its implications.
7. **Craniometric Measurement Proficiency**: Students will gain hands-on experience in craniometry by conducting precise measurements of human skulls, such as cranial length and facial height, allowing them to analyze and interpret cranial variation and its relationship to population diversity.
8. **Data Collection and Reporting**: Students will learn to prepare comprehensive project reports through data collection and analysis of at least 10 families in their area of residence, and will conduct a case study on significant life events, enhancing their research skills and understanding of anthropological fieldwork methods.

DS-3
ANTDSC303T & ANTDSC303P
FUNDAMENTALS OF ANTHROPOLOGY– I

Course Outcomes:

1. **Understanding Human Evolution and Adaptation**: Students will be able to explain the process of hominization, emphasizing key adaptations such as cranial capacity, bipedalism, and manual dexterity, and will analyze the interplay between biological and cultural evolution in human history.
2. **Ecological Concepts and Human Populations**: Students will demonstrate knowledge of ecological principles, including autecology and synecology, and will apply ecological rules (such as Allen's, Bergman's, and Gloger's rules) to understand human adaptation to diverse environments and ecological stressors.
3. **Prehistoric Cultures and Artifacts**: Students will explore world prehistory by identifying and analyzing key archaeological cultures, including Oldowan and Acheulian tools in Africa, as well as Palaeolithic, Mesolithic, and Neolithic cultures in Europe and India, and will assess the significance of prehistoric art.
4. **Cultural Concepts and Tribal Dynamics**: Students will critically examine definitions and attributes of culture as proposed by key anthropologists, explore the concept of tribe in social organization, and analyze the material culture and social structures of specific Indian tribes, including their regional and economic contexts.
5. **Craniometric Measurement Skills**: Students will demonstrate proficiency in craniometry by accurately conducting direct measurements of various linear dimensions, indices, chords, and circumferences on human skulls, enabling them to analyze and interpret cranial variation and

its implications for understanding human evolution and diversity.

6. **Cultural Presentation and Analysis**: Students will prepare and deliver a comprehensive PowerPoint presentation on the material culture and social organization of a selected Indian tribe, developing skills in research, synthesis of information, and effective communication, while engaging in discussion and critique to enhance their understanding of cultural anthropology.

DS-4
ANTDSC404T & ANTDSC404P
FUNDAMENTALS OF ANTHROPOLOGY– II

Course Outcomes:

1. **Understanding Genetic Variation and Population Dynamics**: Students will be able to explain the sources of genetic variation in human populations, including concepts such as mutation, gene flow, and genetic drift, and will analyze intra- and inter- population variation using markers like polymorphic and molecular markers, demonstrating an understanding of typological, populational, and clinal classification models.
2. **Human Growth and Development**: Students will gain insight into the stages of human growth and maturation, articulating the cellular processes involved in development and distinguishing between the prenatal and postnatal stages, which will enhance their comprehension of biological anthropology and its implications for human health and adaptation.
3. **Cultural Evolution and Theoretical Frameworks**: Students will critically assess key theoretical frameworks in social-cultural anthropology, including evolutionism, neo-evolutionism, and diffusionism, and will evaluate the contributions of major theorists such as E.B. Tylor, L.H. Morgan, and Franz Boas, fostering a deeper understanding of how these theories shape the study of culture and society.
4. **Anthropometric Measurement Proficiency**: Students will demonstrate the ability to accurately conduct and analyze anthropometric measurements on at least ten subjects, including head circumference, body weight, and various indices (e.g., Cephalic Index and Body Mass Index), enabling them to assess and interpret human physical variation and its implications for health and population studies.
5. **Analytical Report on Harappan Civilization**: Students will prepare a comprehensive report on the Harappan Civilization, focusing on its geographical, historical, and cultural significance. This report will include a detailed map illustrating major sites, and will emphasize critical aspects such as urban planning, economy, or society, fostering skills in research, critical analysis, and effective communication of anthropological concepts.

DS-5
ANTDSC405T & ANTDSC405P
FUNDAMENTALS OF ANTHROPOLOGY– III

Course Outcomes:

1. **Understanding Human Genetics**: Students will be able to explain the historical development and major milestones in human genetics, describe the various methodologies used in the field, and identify patterns of inheritance and chromosomal aberrations, enhancing their understanding of genetic variation and its implications for human health.
2. **Analyzing Archaeological Cultures**: Students will demonstrate knowledge of key archaeological cultures related to the Iron Age and the second urbanization in India, including the characteristics of various ware cultures and megalithic burial types, and will appreciate the importance of preserving cultural heritage through critical discussions of preservation methods.

3. **Cultural Ecology and Human Adaptation**: Students will analyze the concept of cultural ecology and its application to human adaptation across different subsistence strategies, assessing how ecological themes contribute to state formation and social organization, thereby integrating anthropological perspectives with environmental factors in shaping human societies.
4. **Dermatoglyphic Analysis Skills**: Students will be able to identify and classify different finger and palmar dermatoglyphic patterns, calculate the Pattern Intensity Index, and analyze triradii and main line formulas, enhancing their understanding of the genetic and environmental factors influencing fingerprint characteristics.
5. **Cultural and Historical Insight from Visits**: Students will develop the ability to prepare comprehensive reports based on observations from museum and heritage site visits, demonstrating an understanding of historical artifacts and their cultural significance while reflecting on personal learning experiences and community engagement with cultural heritage.

DS-6
ANTDSC406T & ANTDSC406P
RESEARCH METHODOLOGY

Course Outcomes:

1. **Understanding Research Types**: Students will be able to define and differentiate between various types of research (e.g., descriptive, analytical, exploratory) and identify their appropriate applications in social sciences.
2. **Literature Review and Problem Formulation**: Students will demonstrate the ability to conduct a comprehensive literature review, formulate research problems, and develop clear and testable hypotheses, enhancing their critical thinking and analytical skills.
3. **Research Design Proficiency**: Students will gain proficiency in selecting and designing appropriate research methodologies, including qualitative and quantitative approaches, and will understand the implications of various research designs (e.g., observational, experimental, longitudinal).
4. **Sampling Techniques**: Students will be equipped to apply appropriate sampling techniques, both probability and non-probability, and calculate sample sizes effectively, ensuring the reliability and validity of their research findings.
5. **Data Collection and Analysis Skills**: Students will develop skills in various data collection methods (e.g., interviews, questionnaires, focus groups) and will be able to analyze and present data using descriptive statistics, graphical representations, and other analytical tools, culminating in the preparation of well-structured research reports and proposals.
6. Students will develop practical research skills through immersive fieldwork, enabling them to conduct comprehensive household surveys, analyze demographic data, and produce insightful case studies on the social and cultural life of a locality, while effectively integrating theoretical knowledge with methodological approaches in a real-world context.
7. Students will be able to formulate comprehensive project proposals that clearly articulate research problems, objectives, and methodologies, including the design, sampling, and data analysis, while effectively outlining expected outcomes and budget considerations.
8. Students will gain proficiency in utilizing modern library resources and online databases, enhancing their research skills through hands-on experience in effective information retrieval and net-searching techniques, as evidenced by documented learning processes.

DS-7
ANTDSC407P
FIELDWORK

Course Outcomes:

1. Students will demonstrate an understanding of the relevance and historical context of fieldwork in anthropology by effectively articulating the genesis and tradition of anthropological field studies in their reports.
2. Students will formulate clear aims and objectives for their fieldwork studies, showcasing their ability to develop focused research questions that guide their investigation of the selected community.
3. Students will apply various data collection techniques, such as surveys, interviews, and participant observation, to gather comprehensive information about the community's demographics, subsistence patterns, and social organization.
4. Students will analyze aspects of material culture and local practices, illustrating their findings through case studies that highlight the community's principal occupations, market interactions, and cultural rituals.
5. Students will critically assess the impacts of development and welfare programs on the studied community, evaluating economic, health, education, and infrastructure issues while providing recommendations for future initiatives.

DS–8
ANTDSC508T & ANTDSC508P
HUMAN GENETICS

Course Outcomes:

1. Students will be able to apply various methods of studying human genetics, including pedigree analysis and twin studies, to assess heritability and understand genetic traits within populations.
2. Students will demonstrate knowledge of genetic markers, such as the ABO and Rh blood group systems, and their relevance in population genetics and individual identification.
3. Students will analyze genetic variation and polymorphism in key biochemical markers (e.g., G6PD, lactate dehydrogenase) and their implications for human health and disease.
4. Students will critically evaluate the inheritance patterns of hemoglobin variants and inborn errors of metabolism, including their biochemical pathways and associated health conditions.
5. Students will accurately perform blood group typing for the ABO and Rh (D) systems, interpreting results from at least 10 subjects to understand the significance of blood groups in transfusion and genetics.
6. Students will identify and analyze the inheritance patterns of color blindness (Deuteranopia and Protanopia) through testing at least 10 subjects, exploring the genetic mechanisms behind these conditions.
7. Students will demonstrate the ability to identify sex chromatin through the examination of inactivated X-chromosomes, using laboratory techniques or photographic evidence to differentiate between male and female genetic samples.

DS 9
ANTDSC509T & ANTDSC509P
HUMAN BIOLOGY

Course Outcomes:

1. Students will be able to analyze and interpret distance and velocity growth curves, understanding their significance in assessing human growth patterns and biological age versus chronological age.
2. Students will evaluate the impact of biological and cultural factors on human growth, including genetic, socio-cultural, and ecological influences, as well as secular trends related to stature and age at menarche.
3. Students will demonstrate proficiency in using various methods of studying human growth—cross-sectional, longitudinal, mixed, and linked longitudinal—highlighting their significance and applicability in research.
4. Students will describe physiological factors influencing growth, including hematological parameters, blood pressure, heart rate, and pulse rate, and explore secular trends in growth and gerontology.
5. Students will classify human physique using Sheldon and Heath-Carter methods of somatotyping and explain the concept of Kinanthropometry, as well as discuss alternative methods of assisted reproduction and the associated ethical and legal issues.
6. Students will be able to accurately measure and analyze cardiovascular function by assessing blood pressure and pulse rate across multiple subjects, understanding the physiological implications of these measurements.
7. Students will demonstrate proficiency in applying the Heath-Carter method of somatotyping, using both rating forms and formulas, to evaluate and plot somatotypes on a somatochart for a sample of subjects, thereby enhancing their understanding of body composition and physical characteristics.

DS-10
ANTDSC510T & ANTDSC510P
PREHISTORIC CULTURE IN INDIA

Course Outcomes:

1. Students will be able to trace the historical development of Indian prehistory by identifying and differentiating various cultural phases and terminologies across different geographical regions, from the time of R. B. Foote to the present.
2. Students will analyze paleoenvironmental conditions in India, focusing on glacial and pluvial zones, and assess their impact on human settlement and cultural development in regions such as Potwar Plateau, Kashmir, and the Narmada Valley.
3. Students will demonstrate an understanding of early tool-making traditions by describing and comparing the characteristics of the Chopper-Chopping culture, Pebble Tool culture, and Narmada culture, highlighting their significance in human prehistory.
4. Students will evaluate the Flake Tool culture by examining specific sites (e.g., Bellan Valley, Nevasa) to understand the technological advancements and cultural implications of flake tools in prehistoric India.
5. Students will investigate the Microlithic and Neolithic cultures of India, exploring key sites and their contributions to the understanding of subsistence strategies, social organization, and artistic expression during these periods.
6. Students will accurately interpret and analyze topographic maps, including understanding

scales, contour lines, and drainage patterns, enabling them to produce contour sections and assess vegetation cover effectively.

7. Students will demonstrate proficiency in using Remote Sensing and GIS software, such as Google Earth and ISRO Bhuvan, to visualize and analyze geographical data, enhancing their spatial analysis skills.
8. Students will conduct field explorations to study geomorphological features, applying techniques such as GPS and grid methods for measurements, and identifying culture- bearing deposits, thereby integrating theoretical knowledge with practical fieldwork experience.

DS–11
ANTDSC511T
TRIBAL STUDIES IN ANTHROPOLOGY

Course Outcomes:

1. Students will critically analyze the historical development of Tribal Studies in India, articulating the definitions, nature, and scope of the discipline, as well as understanding concepts like tribal identity, indigeneity, and the significance of Scheduled Tribes.
2. Students will evaluate the demographic composition and ecological settings of tribal populations in India, assessing their economic conditions and techno-economic levels to gain insight into their socio-economic realities.
3. Students will investigate significant tribal movements in India, such as the Kol Mutiny and the Jharkhand Movement, examining their features, nature, functions, and impact on tribal rights and identity.
4. Students will explore historical and contemporary tribal policies in India, including constitutional provisions and welfare strategies, critically assessing the effectiveness of these policies in promoting tribal development and empowerment.
5. Students will identify and analyze key challenges faced by Indian tribes, including economic, educational, political, and health issues, fostering an understanding of land alienation, employment, migration, and the relationship between forests and tribal communities.
6. Students will conduct a comprehensive evaluation of a selected Tribal Development Programme, articulating its aims and objectives, analyzing relevant constitutional provisions, understanding its conceptual framework and functionaries, and synthesizing available secondary data to identify key issues and outcomes related to the programme's effectiveness and impact on tribal communities.

DS-12
ANTDSC612T
INDIAN ANTHROPOLOGY

Course Outcomes:

1. **Understanding the Evolution of Indian Anthropology**: Students will demonstrate knowledge of the origin, history, and development of Anthropology in India, including its major phases and the contributions of key Indian anthropologists such as
S. C. Roy and M. N. Srinivas.
2. **Analyzing Village Studies in India**: Students will critically evaluate the significance of village studies, exploring the concepts, features, and types of villages in India, as well as the contributions of notable anthropologists to the understanding of traditional and contemporary

village life.

3. **Exploring Social Structures and Change**: Students will analyze the traditional Indian social system, including concepts of Varna, Jati, and caste, while also examining the factors and reasons for social change in India, incorporating key theoretical frameworks such as Sanskritization and Westernization.
4. **Critical Analysis of Anthropological Contributions**: Students will demonstrate the ability to critically assess and articulate the contributions of two selected Indian anthropologists, highlighting their influence on the field of anthropology in India and their impact on the understanding of social, cultural, and tribal dynamics.
5. **Evaluation of Institutional Roles in Anthropology**: Students will effectively analyze and report on the role of a chosen institution (such as the Asiatic Society or the Anthropological Survey of India), detailing its historical significance, contributions to the development of anthropology, and its impact on research and education in the field.

DS-13
ANTDSC613T & ANTDSC613P
ANTHROPOLOGICAL DEMOGRAPHY AND HEALTH

Course Outcomes:

1. **Understanding Demographic Concepts**: Students will be able to define and apply key concepts in anthropological demography, including the interpretation of demographic measures (such as fertility rates, mortality rates, and population pyramids) and analyze their significance in understanding population dynamics.
2. **Biocultural Perspectives in Health**: Students will evaluate the interplay between biological and cultural factors in health and illness, distinguishing between biomedicine and ethnomedicine, and critically assess how these perspectives influence disease patterns and nutritional status in various populations.
3. **Assessment of Nutritional Status**: Students will develop the skills to assess nutritional status using anthropometric, biochemical, clinical, and dietary survey methods, while understanding the implications of malnutrition and applying z-score statistics to evaluate the prevalence of acute malnutrition in children.
4. **Nutritional Status Evaluation in Children**: Students will be able to assess and analyze the nutritional status of children using key anthropometric measurements (such as Head Circumference, MUAC, BMI for age, Stunting, Wasting, Underweight, and CIAF) and effectively compare these assessments against WHO standards to identify potential nutritional deficiencies.
5. **Assessment of Adult Health Risks**: Students will learn to evaluate the nutritional status and risk factors for non-communicable diseases in adults by applying various anthropometric indices (WHR, WHtR, Conicity Index, and BMI) on at least 10 subjects, enabling them to interpret findings in the context of public health guidelines.

DS-14
ANTDSC614T & ANTDSC614P
APPLIED ANTHROPOLOGY

Course Outcomes:

1. **Conceptual Foundations of Applied Anthropology**: Students will be able to define applied anthropology and distinguish between its various branches—applied, action, and development anthropology—while understanding their historical development and analyzing empirical

examples from relevant projects.

2. **Anthropology in Development Contexts**: Students will explore the concepts of development anthropology and the anthropology of development, demonstrating an understanding of sustainable development and its anthropological significance, as well as critiquing key theories such as modernization, dependency, and world systems theory.
3. **Protection and Management of Archaeological Heritage**: Students will identify threats to archaeological remains and evaluate protective measures, including international and national legal frameworks (e.g., UNESCO laws), while discussing the socio-political implications of archaeology concerning identity and land rights.
4. **Ethical Implications in Applied Human Genetics**: Students will assess the ethical, legal, and social implications of applied human genetics, including the complexities of eugenics, genetic screening, and genetic counseling, and discuss the impact of the Human Genome Project and epigenetics on society.
5. **Physiological Perspectives in Sports Anthropology**: Students will analyze the relationship between body proportions and sports efficiency through the lens of physiological anthropology, enabling them to apply anthropological principles to the study of sports and physical performance.
6. **Forensic Anthropology Techniques and Applications**: Students will gain practical knowledge in forensic anthropology methods, including personal identification techniques such as osteometry, serology, DNA fingerprinting, and the application of dermatoglyphics, with a focus on current methodologies for developing and analyzing fingerprint evidence in legal contexts.
7. **Application of Osteometric Techniques**: Students will demonstrate the ability to estimate stature from long bones and footprints, as well as age from skull and teeth, through practical analysis of at least ten samples for each method, thereby applying anthropometric techniques in forensic contexts.
8. **Dermatoglyphics for Personal Identification**: Students will acquire skills in dermatoglyphics by developing latent prints and conducting personal identification using ridge count (AFRC, TFRC) and minutiae analysis, enabling them to apply these techniques to forensic investigations involving fingerprint evidence.

DS-15
ANTDSC615T
SOCIAL THOUGHTS AND THEORIES

Course Outcomes:

1. **Understanding Anthropological Foundations**: Students will articulate the key concepts of Enlightenment and Positivism as proposed by Auguste Comte, and analyze how these ideas influenced the development of anthropological thought.
2. **Application of Sociological Theories**: Students will critically evaluate the foundational theories of sociology as articulated by Emile Durkheim, Marcel Mauss, and Max Weber, and discuss their relevance to contemporary anthropological research.
3. **Functionalism and Its Proponents**: Students will assess the contributions of Bronislaw Malinowski, Talcott Parsons, and E.E. Evans-Pritchard to functionalist theory, and explain the implications of structural functionalism as defined by A.R. Radcliffe-Brown.
4. **Exploration of Structuralism**: Students will analyze the principles of structuralism as developed by Claude Lévi-Strauss and Edmund Leach, and apply these concepts to case studies in cultural analysis.
5. **Cultural and Personality Perspectives**: Students will compare and contrast the approaches of Ruth Benedict, Margaret Mead, Ralph Linton, and Alice Cora Du Bois in the Culture and Personality school of thought, and evaluate their impact on understanding cultural behavior.

6. **Engagement with Contemporary Theories**: Students will demonstrate knowledge of contemporary social theories, including Poststructuralism, Postmodernism, Critical Theory, Feminism, Postcolonialism, and Orientalism, and critically analyze their implications for current anthropological discourse.
7. Students will critically apply the concepts and frameworks of anthropological theories discussed in the course to analyze and assess a contemporary event, demonstrating their ability to synthesize theoretical knowledge with real-world issues and articulate informed insights.

DS-16
ANTDSC716T & ANTDSC716P
MOLECULAR ANTHROPOLOGY AND HUMAN EVOLUTION

Course Outcomes:

1. **Molecular Understanding**: Students will demonstrate a comprehensive understanding of the chemistry and topology of DNA, including its unique and repetitive sequences, as well as mechanisms of mutation and DNA repair, enabling them to discuss the implications for genetic stability and variability.
2. **Application of Molecular Markers**: Students will be able to explain and differentiate various molecular markers (RFLPs, VNTRs, STRs, SNPs, CNVs, mtDNA) and their applications in anthropological research, including their role in population genetics and evolutionary studies.
3. **Genomic Diversity and Evolution**: Students will analyze the structure of the human genome and its diversity, exploring the genetic basis for immune responses and the implications for human evolution, thereby linking molecular biology with anthropological concepts.
4. **Phylogenetic Analysis**: Students will apply molecular phylogenetic methods to explore human ancestry and population structure, critically assessing the implications of different models (e.g., Mitochondrial Eve vs. Multiregional Hypothesis) on understanding human migrations and evolution.
5. **Molecular Diversity and Language**: Students will evaluate the relationship between genetic diversity in contemporary populations and linguistic variation, articulating how genetic markers can provide insights into human migration patterns and cultural interactions.
6. **Palaeodemography Insights**: Students will assess concepts of palaeodemography, including population size, mortality, and fertility rates, to understand human demographic changes before and after the advent of agriculture, fostering a deeper comprehension of how societal developments impact human populations.
7. **Proficiency in Angular Measurements**: Students will demonstrate the ability to accurately perform direct angular measurements on craniofacial features, including the frontal profile angle, nasal profile angle, and alveolar profile angle, enhancing their skills in anthropometric analysis.
8. **Application of Craniographic Techniques**: Students will be able to conduct measurements using a craniograph, analyzing cranial quadrilaterals and various curvature angles, which will facilitate a deeper understanding of cranial morphology and its implications in anthropological research.
9. **Expertise in Osteometric Analysis**: Students will acquire skills in indirect osteometric measurements by interpreting diaptograph tracings of long bones, such as the femur and humerus, enabling them to assess skeletal dimensions and angles relevant to human variation and evolutionary studies.

DS-17
ANTDSC717T
ADVANCED RESEARCH METHODOLOGY

Course Outcomes:

1. **Proficiency in Qualitative Data Analysis**: Students will demonstrate the ability to apply various qualitative analysis methods, including text and discourse analysis, coding, and componential analysis, to interpret ethnographic data effectively.
2. **Competence in Quantitative Data Analysis**: Students will gain proficiency in performing quantitative analyses, utilizing statistical methods such as t-tests, ANOVA, and regression analysis, to draw meaningful conclusions from numerical data.
3. **Understanding Research Ethics**: Students will understand key concepts in research ethics, including bioethics and the implications of scientific misconduct, enabling them to conduct research responsibly and ethically.
4. **Awareness of Publication Ethics**: Students will recognize the importance of publication ethics, including authorship standards and best practices, preparing them to engage with the academic community in a responsible manner.
5. **Critical Evaluation of Statistical Techniques**: Students will be able to critically evaluate and select appropriate statistical techniques for data analysis based on the nature of the research question and data type.
6. **Identification of Ethical Violations**: Students will learn to identify potential violations of research and publication ethics, including plagiarism and conflicts of interest, and understand the procedures for addressing such issues in academic settings.
7. **Proficiency in Software Applications**: Students will demonstrate the ability to effectively use Word, Excel, PowerPoint, and SPSS for creating documents, managing data, conducting statistical analysis, and delivering presentations in an academic and professional context.

DS-18
ANTDSC818T & ANTDSC818P
ADVANCED ANTHROPOLOGY

Course Outcomes:

1. **Understanding Population Genetics**: Students will demonstrate knowledge of mating patterns, allele frequency estimation, and the genetic consequences of consanguinity and inbreeding, enabling them to analyze population structures and their evolutionary implications.
2. **Application of Forensic Archaeology**: Students will be able to apply forensic archaeology principles to recover and preserve evidence from archaeological sites, including human skeletal remains, and understand the scope and tasks involved in forensic investigations.
3. **Analysis of Contemporary Issues Using Social-Cultural Anthropology**: Students will utilize social-cultural anthropology frameworks to address contemporary global challenges, such as disasters, violence, and environmental issues, and propose anthropological solutions to these problems.
4. **Critical Engagement with Globalization**: Students will critically assess the impacts of globalization on tribal communities and analyze demographic, economic, and political changes resulting from global interactions, applying anthropological insights to contemporary issues.
5. **Genetic Data Analysis Skills**: Students will demonstrate the ability to estimate allele frequencies, calculate heterozygosity scores, and assess genetic distances using methods like Mahalanobis D^2 and Sanghvi G^2, as well as understand the implications of the fixation index (Fst) in population genetics.

6. **Assessment of Archaeological Sites**: Students will develop a comprehensive project report evaluating prehistoric or protohistoric sites for potential inclusion in the National Register, identifying limitations, and providing recommendations based on ICOMOS and UNESCO guidelines for heritage preservation.
7. **Application of Social-Cultural Anthropology**: Students will conduct a project analyzing the impacts of globalization on local socio-cultural phenomena or development issues, demonstrating the role of social-cultural anthropology in interpreting these changes and proposing strategies for community development and environmental health.

DS-19
ANTDSC819T
ANTHROPOLOGY OF FOLKLORE AND LINGUISTICS

Course Outcomes:

1. **Understanding Folklore Concepts**: Students will articulate the concepts of "folk" and "folklore" within the context of anthropology, identifying key subfields and outlining the history of folklore studies, including methodologies for fieldwork in folkloristic anthropology.
2. **Analysis of Regional Folklores**: Students will analyze various regional folklores in India, exploring their manifestations in material culture, including food, dress, architecture, and technology, as well as in folk arts such as graphic and performing arts.
3. **Linguistic Anthropology Framework**: Students will explain the definition, aims, and scope of linguistic anthropology, tracing its historical development and examining the interplay between language and social life.
4. **Structural Linguistics Proficiency**: Students will demonstrate an understanding of structural linguistics by identifying and explaining the components of morphology, phonology, syntax, and semantics, and their roles in language structure.
5. **Documentation of Communication Styles**: Students will document and analyze variations in day-to-day communication styles among at least five families in West Bengal, focusing on gendered issues and intergenerational differences in naming practices, highlighting the effects of cultural contact on these practices.
6. **Assessment of Social Media Influence**: Students will evaluate the impacts of social media on verbal and written communication within families, presenting findings on how digital interactions shape linguistic practices and cultural expressions in their local context.

DS-20
ANTDSC820T
RURAL AND URBAN ANTHROPOLOGY

Course Outcomes:

1. **Analysis of Agrarian Structures**: Students will critically analyze the agrarian social structure in India, exploring the concepts of land tenure systems, agrarian unrest, andthe significance of land reforms, with a focus on understanding the dynamics of factionalism within rural societies.
2. **Evaluation of Peasant Movements**: Students will evaluate key peasant movements in India, such as the Moplah Rebellion and the Naxalbari Struggle, assessing their historical contexts, causes, and impacts on contemporary rural society, and drawing connections to current rural struggles.
3. **Understanding Urban Dynamics**: Students will explore the definitions and concepts of urbanism and urbanization, examining the historical and contemporary issues in urban anthropology, including urban poverty, inequality, and the cultural roles of cities, while

employing methodological approaches to urban ethnography.

4. **Demographic and Social Analysis**: Students will conduct a detailed demographic analysis and explore the socio-cultural relationships among neighbors within an urban setting, culminating in a comprehensive project report that highlights community dynamics and interactions.
5. **Cultural Documentation**: Students will document and analyze a popular culture performance or urban market, using photography and descriptive text to illustrate the cultural attributes and significance of the chosen event or setting, thereby enhancing their understanding of urban cultural expressions.

DS-21
ANTDSC821P
PROJECT WORK

Course Outcomes:

1. **Field Research Skills**: Students will develop practical field research skills by designing and executing a project on a specific topic within the major sub-disciplines of anthropology, fostering critical thinking and methodological competencies in data collection and analysis.
2. **Academic Reporting**: Students will enhance their ability to compile and present research findings through the preparation of a well-structured report, demonstrating proficiency in written communication and adherence to academic standards.
3. **Collaborative Learning**: Students will engage in collaborative discussions with supervisors to refine their project topics, promoting teamwork and the integration of diverse perspectives within the anthropological framework.

ANTRES801P
RESEARCH WORK

Course Outcomes:

1. **Research Proposal Development**: Students will demonstrate the ability to formulate a comprehensive research proposal, including a clear problem statement, literature review, objectives, and methodology, which will provide a strong foundation for their fieldwork.
2. **Fieldwork Implementation**: Students will gain hands-on experience by conducting fieldwork, allowing them to apply anthropological research methods and techniques in real-world settings while collecting and analyzing qualitative and quantitative data.
3. **Analytical Skills**: Students will enhance their analytical skills by interpreting data collected during fieldwork and discussing the implications of their findings within the context of existing literature, contributing to scholarly discourse in anthropology.
4. **Report Writing Proficiency**: Students will develop proficiency in academic writing by producing a structured research report that adheres to scholarly standards, including proper citation and referencing, thereby enhancing their communication skills.
5. **Project Management**: Students will learn to effectively manage research timelines and budgets, fostering organizational skills and the ability to navigate logistical challenges associated with conducting field-based research.

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
ANTHSE101M/ANTHSE303M
PUBLIC HEALTH & EPIDEMIOLOGY

Course Outcomes:

1. The students will learn about how a community health centre works and delivers healthcare to the people.
2. They will also learn how to document the healthcare delivery systems as they exist in actual situations.
3. From the practical component they will learn about collection of data on healthcare delivery and preparation of a report on the same.

SE–2
ANTHSE202M
ANTHROPOLOGY OF TOURISM

Course Outcomes:

1. The students will learn about various types of tourism and how anthropologists look at them.
2. They will also learn about various aspects of tourism management, promotion of tourism, local culture and local economy.
3. From the practical component they will learn how tourism and travel agencies actually function, how they serve the tourists, and how they make a living not only for themselves but also for many engaged in subsidiary activities like providing transport, guide, etc.

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3
ANTHMD101T / ANTHMD201T / ANTHMD301T

Course Outcomes:

1. Students will learn about the basic concepts of the discipline of Anthropology and its other branches. They will also learn about relationship of anthropology with other allied disciplines.
2. The students will learn about the origin of hominoid group in the primates and the origin, distribution and characteristics of extinct hominids and the process of hominization.
3. Students will learn about principles of human evolution and variation, morphological features of man, skeletal morphology with reference to evolutionary change.
4. The students will learn about important dimensions of the discipline of Anthropology such as race, racial criteria and factor responsible for race formation.
5. Students will learn about the concept of culture in prehistory and stone tools and artefacts, geochronology and palaeo-environment.
6. Students will learn about the basic concept of society and culture. They will learn about important social institutions such as family, marriage and kinship apart from religion, magic and descent groups.
7. They will also learn about the method of understanding the prehistoric culture on the basis of archaeological finds

POST GRADUATE PROGRAMME OUTCOME AND COURSE OUTCOME

COURSE OFFERED

Semester 1	Semester 2	Semester 3	Semester 4
CC-1, CC-2, CC-3, CC-4 CC-5, AECC-1	CC-6, CC-7, CC-8, CC-9 CC-10, SEC-1	CC-11, CC-12, CC-13, DSE-1(A,B,C), DSE-2(A,B,C), GE-1	CC-14, CC-15, DSE-3 (A,B,C), DSE-4 (A,B,C), DSE-5 (A,B,C)

Progamme Outcomes	
PO 1	Students should acquire knowledge about the different concepts & Branches of Anthropology in a holistic and specialized way.
PO 2	Students should undertake Laboratory Practical and fieldwork k oriented activities and develop practical knowledge and skills on qualitative and quantitative analysis and case study formulation required for perusing career in different specialized areas in Anthropology with special emphasis on Research & Dissertation.
PO 3	Recognize, appreciate and practice Anthropological knowledge and its application in academic, administrative, Environmental, various social and developmental context particularly in context of professional assignments.

Programme Specific Outcomes	
PSO 1	**Diverse Methodologies Across Subfields**: Each subfield of Anthropology (such as cultural, biological, archaeological, and linguistic anthropology) employs distinct methods to study humanity.
PSO 2	**Holistic and Global Perspective**: The curriculum fosters a comprehensive understanding of human societies and cultures across time and space, encouraging a global worldview.
PSO 3	**Appreciation of Human Diversity**: Students develop a deep respect for biological and cultural diversity, encompassing both historical and contemporary human experiences.
PSO 4	**Critical Thinking Development**: By engaging with anthropological data and issues, students sharpen their analytical and critical thinking skills.
PSO 5	**Reflective Understanding of Self and Society**: Anthropological study helps students understand their own cultural and biological context by comparing it with others.
PSO 6	**Cultural Relativism and Sensitivity**: The programme emphasizes understanding cultures on their own terms, promoting tolerance and reducing ethnocentrism.
PSO 7	**Integration of Biological and Cultural Aspects**: Students learn to synthesize insights from both biological and cultural anthropology to gain a fuller picture of human life.
PSO 8	**Career-Oriented Learning**: The curriculum introduces students to career paths related to anthropology in government, NGOs, and entrepreneurial sectors.
PSO 9	**Application of Anthropological Inquiry**: Students are trained in research techniques and ethnographic inquiry, encouraging independent exploration of human issues.
PSO 10	**Preparation for Interdisciplinary Fields**: The course equips students with skills applicable in related fields such as public health, development studies, forensics, heritage management, and social work.

POST GRADUATE PROGRAMME OUTCOME AND COURSE OUTCOME MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10
CC-1	Y	Y	Y							
CC-2	Y	Y	Y							
CC-3	Y	Y	Y			Y				
CC-4	Y	Y	Y						Y	Y
CC-5	Y	Y	Y	Y	Y	Y		Y	Y	Y
CC-6	Y	Y	Y	Y						
CC-7	Y	Y	Y	Y						
CC-8	Y	Y	Y	Y		Y				
CC-9	Y	Y	Y	Y			Y		Y	Y
CC-10	Y	Y	Y	Y	Y			Y	Y	Y
CC-11	Y	Y	Y	Y	Y	Y				
CC-12	Y	Y	Y	Y			Y			
CC-13	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CC-14	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CC-15	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
DSE-1	Y	Y	Y	Y	Y	Y				
DSE-2	Y	Y	Y	Y	Y	Y		Y	Y	
DSE-3	Y	Y	Y	Y	Y	Y				
DSE-4	Y	Y	Y	Y	Y	Y		Y		Y
DSE-5	Y	Y	Y	Y	Y	Y		Y	Y	Y
AECC-1	Y	Y	Y						Y	
SEC-1	Y	Y	Y					Y	Y	Y
GE-1	Y	Y	Y							Y

CORE COURSES

CC-1
Biological Anthropology-I

COURSE OUTCOME

1. various theories and processes of evolution.
2. primate skeletal and morphological characters and their behavior in respect of evolution.
3. biological evolution of hominids.
4. human variation in respect of morphological and genetic traits of human.
5. how human body adaptations to various ecological conditions.

CC-2
Archaeological Anthropology-I

COURSE OUTCOME

1. This course deals with the basic identity of the area of specialization along with its relevant issues
2. It also logically interprets the bio-cultural postulates of human evolution.

CC-3
Social-Cultural Anthropology-I

COURSE OUTCOME

1. The course shares an interest in subject matter, distinguishing futures and development of the major sub field
2. It throws light on various components attributes, concepts of the core area of culture
3. The students also have to acquire a sound knowledge on ethnographic approach as the mainstay of the subfield

CC-4
Biological- and Archaeological Anthropology (Practical)

COURSE OUTCOME

1. how to handle anthropometric instrument.
2. to take craniometric and osteometric measurements to understand human biological evolution and variation.
4. about primate behavior in respect of evolution.
5. how to handle and analyze prehistoric tools and artifacts

CC-5
Fieldwork in Social-Cultural Anthropology (Practical)

COURSE OUTCOME

1. In this practical course students can understand the patterns of behavior in cultural contexts of rural and urban society.
2. This course also deals with the data from different levels of culture and its analyses in the field.

CC-6
Biological Anthropology-II

COURSE OUTCOME

1. The students will learn about different methods of human genetics.
2. They will learn about how offspring inherit genetic traits from their parents.
3. They will also learn about concept of human genetic variation with special emphasis on above said genetic markers.
4. They will also learn basics of human growth and development.

CC-7
Archaeological Anthropology-II

COURSE OUTCOME

1. This course deals with the cultural sequences of prehistoric context from Palaeolithic to Chalcolithic phase.
2. This course also let the student know about the details of those cultural sequences along with their representative evidences.

CC-8
Social-Cultural Anthropology-II

COURSE OUTCOME

1. In this course the concepts of culture become more variegated in the form of economy, politics, religion, language and rural society etc. Along with some theoretical models of the subfield.
2. The course is also introduced may areas of culture for the future research.
3. It also covers interdisciplinary collaboration as a hallmark of this subfield.

CC-9
Biological and Social-Cultural Anthropology (Practical)

COURSE OUTCOME

1. From the practical component they will learn how to handle anthropometric and other instruments.
2. They will also learn to assess nutritional status, inheritance pattern, ABO and Rh blood type, dermatoglyphics and Colour-blind test.
3. They will learn to draw genealogical chart and will identify it's importance.
4. They will learn to review the book along with its objectives and subject matters.

CC-10
Fieldwork in Biological Anthropology and Archaeological Anthropology (Practical)

COURSE OUTCOME

1. They will learn to use various fieldwork methods and techniques to collect data.
2. They will also learn how to collate the data, draw tables or charts, interpret the data and draw appropriate generalizations from the same.
3. They will also learn how to communicate how they have done their fieldwork, and what are the implications of their findings.

CC-11
INDIAN ANTHROPOLOGY

COURSE OUTCOME

1. Students will learn about history and development of Indian Anthroplogy
2. They will learn tribal situation in India.
3. They will also learn traditional social systems of India.
4. They will also learn about biological diversity of Indian population

CC-12
Research Methodology

COURSE OUTCOME

1. fieldwork and its relationship with anthropology.
2. preparing for fieldwork and selection of field site.
3. various methods and techniques of data collection.
4. use statistics in anthropological research and draw inferences.

CC-13
Applied Anthropology

COURSE OUTCOME

1. applied anthropology and the various fields in which anthropological knowledge can be applied.
2. application of anthropological knowledge in the field of development, modernisation, industrialisation, urbanisation, human genetics, nutrition, sports, forensic, gender etc.
3. application of anthropological knowledge for the welfare and development of vulnerable groups.

CC-14
Anthropological Approaches to the study of Health

COURSE OUTCOME

1. The students will learn about basic concepts about health, sickness and disease from
1. anthropological perspectives.
2. They will learn about various ethnomedical practices in India.
3. They will also learn about medical pluralism in India.
4. They will learn different demographic rates and ratios and its interpretations.
5. Medical anthropology is one of the most rapidly growing areas in which students have to acquire their knowledge on health, illness and healing as well as the holistic dimension of health care system cross culturally. It also includes the theoretical approaches of the same which will be benefited to have the empirical dimension to, in their research in future.

CC 15
Dissertation-I

COURSE OUTCOME

This practical course helps to study different aspects of biological, archaeological and social cultural issues for future research

The students also can have a skill undertaking different issues as their area of research individually.

DEPARTMENT SPECIFIC ELECTIVES (DSE)

DSE-1A
Human Evolution

COURSE OUTCOME

1. Human evolution with special reference to evolutionary genetics
2. Theory and evidences of human evolution.
3. Selection process
4. Paleodemography of early population.
5.

DSE-1B

Theoretical Contributions in Cultural Anthropology (20^{TH} Century & onwards)

COURSE OUTCOME

1. This course is consisted of two parts deal with the theoretical issues of the subfield from mid 20^{th} Century along with their proponents and empirical contexts.
2. The students will be benefited by knowing the debates as well as criticisms of the same and also the heart of the basic postulate of theoretical understanding in a trans- disciplinary dimension.

DSE-1C
Pleistocene Environment and Evolution of Culture in India and the World

COURSE OUTCOME

1. Pleistocene environmental condition in India the world.
2. Cultural evolution during Pleistocene throughout the world and India.
3. Holocene cultural evolution throughout the world and India

DSE-2A
Practical in Advanced Biological Anthropology-I

COURSE OUTCOME

1. The students will learn about linear and angular measurement of skull as well as measurement of long bones through diaptograph tracing.
2. They will also learn skinfold measurements and Somatotyping.
3. They will also learn computer applications for data entry and analysis

DSE-2B
Practical in Advanced Social Cultural Anthropology-I

COURSE OUTCOME

1. Students can understand the concept of traditional rural technology along with their structural functional issues
2. They can also conceive the changing patterns of traditional technology with their factors.

DSE-2C
Advanced Archaeological Anthropology- I (Practical)

COURSE OUTCOME

1. Students will learn various morphometric analysis methods of biface tools.
2. They will learn about scientific method of drawing and analysis of prehistoric potsherds.
3. Students will have practical knowledge about hardness attributes of various lithic raw materials and will also learn about basic identifying features of Pleistocene mammal fossils.

DSE-3A
Human Genetics

COURSE OUTCOME

1. The students will learn about genetic polymorphism and how it is explained by various theories.
2. They will also learn about genetic abnormalities in populations and the reasons thereof.
3. They will also learn about calculation of allele frequencies.

DSE-3B
Ecology, Culture and Society

COURSE OUTCOME

1. This course contains some relevant sociocultural issues of the day to day life like Ecology, Gender, Ethnicity and Aging.
2. The study of interrelationships among human beings, culture in the ecological settings, is the vital as well as thrust area of this course.
3. The course also views the concept of cross cultural variation in gender roles and other spheres of culture.
4. Finally this course will enrich the students about the local and national issues relating to gender, ethnicity and aging.

DSE-3C
Biological Evolution, History of Technology, Theoretical Concepts in Archaeology and Ethnoarchaeology

COURSE OUTCOME

1. Various theories of evolution and biological evolution of hominoids and hominids throughout the world.
2. Various hypotheses regarding origin of genus homo and modern human in the world.
3. Process and mechanism of hominization. They will learn about history and evolution of technology.
4. Theoretical development in Archaeological Anthropology.
5. The importance of ethnographic data to understand archaeological context and cultural process.

DSE-4A
Human Biology

COURSE OUTCOME

1. The students will learn about the concepts of growth, maturation and development.

2. They will learn about factors responsible for growth.
3. They will also learn about various methods of somatotyping.
4. They will learn about human reproductive systems and reproduction
5. They will learn nutrition and its assessments.

DSE-4B
Anthropology of Organization and Human Rights

COURSE OUTCOME

1. This course deals with the understanding of business and organization as well as rule governed behaviour under the purview of business/organizational anthropology. In the present day dynamic world students can understand the sociocultural dimension of global business network through discourse along with business issues, business group, organizational structure, change diversity and globalization
2. This course also throws lights on the important area of tourism and its sustainability.
3. The other part of the course consists of the most relevant issue of society i.e. Human rights students can conceptualised the state as the fundamental task to create and effort adequate protection of people along with the realization of human rights.
4. The other two units also throw to other pertinent issues like communication and globalization

DSE-4C
Experimental Archaeology and advanced study on stone tool analysis

COURSE OUTCOME

1. The importance of experimental approach in archaeological research.
2. Some advanced approaches and methods in stone tool analysis.
3. The importance of debitage or waste flakes in lithic analysis and will also learn about some methods of debitage analysis.

DSE-5A
Advanced Biological Anthropology-II (Practical)

COURSE OUTCOME

1. The students will learn about identification on the basis of various biological materials like finger prints, blood stains etc.
2. They will learn about sex chromatin identification and karyotyping
3. They will also learn preparation and identification of PTC threshold values.
4. They will learn how to measure and interpret blood pressure.

DSE-5B
Advanced Social-Cultural Anthropology-II (Practical)

COURSE OUTCOME

The students will learn about how to prepare a project for development and how to review a development project.

DSE-5C
Advanced Archaeological Anthropology- II (Practical)

COURSE OUTCOME

1. Students will have practical knowledge about basic petrographic attributes of various lithic raw materials.
2. Students will have ideas about identification of macroscopic use breakages in lithic artifacts and will learn to classify artifacts on the basis of use breakages

SKILL ENHANCEMENT COURSE (SEC)

SEC-1
Anthropology of Social Impact Assessment

COURSE OUTCOME
1. The students will learn about the concepts and approaches in SIA.
2. The students will learn how to conduct an SIA and write a report on the same.
3. The course will help students regarding employability in government and non government sectors.

ABILITY ENHANCEMENT (COMPULSORY COURSE)
AECC-1

COURSE OUTCOME

1. The students will learn about the importance of fieldwork in social sciences in general and anthropology in particular.
2. They will learn about the steps to be taken before finalising the site of fieldwork.
3. They will also learn about participant observation and how to elicit the native's point of view.
4. They will learn how to use computer and internet.

GENERIC ELECTIVE (GE)
GE-1

COURSE OUTCOME

Students will learn basic and holistic dimensions of anthropology and its importance. Students will correlate anthropological knowledge with their own discipline.

For UG NEP2020 syllabus of Anthropology in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2024/11/NEP_UG_CURRICULUM_ANTHROPOLOGY-2023-24-1.pdf

Program and Course Learning outcome of Undergraduate course

Department of Bengali

BIDHANNAGAR COLLEGE

SALT LAKE

INTRODUCTION

The Bengali Major syllabus under the National Education Policy (NEP) 2020 framework at West Bengal State University reflects a visionary restructuring of undergraduate education, emphasizing a multidisciplinary, outcome-based, and culturally rooted academic approach. Anchored in the principles of flexibility, critical thinking, and skill development, the syllabus has been redesigned to engage learners not only in linguistic and literary competencies but also in broader socio-cultural and intellectual discourses.

A distinctive feature of the new curriculum is the thoughtful integration of the Indian Knowledge System (IKS), with a focus on indigenous literary traditions, classical and medieval Bengali texts, and vernacular epistemologies. The curriculum foregrounds the contributions of luminaries from Bengal—such as Chandidas, Vidyapati, Rabindranath Tagore, Bankim Chandra Chattopadhyay, and Kazi Nazrul Islam—within the broader framework of Indian aesthetics, poetics (Alankara Shastra), and narrative traditions (Katha Sahitya). This fosters a deeper appreciation of the regional within the national, and the textual within the philosophical.

Courses are designed to balance canonical literary heritage with emerging domains such as Knowledge on Printing & Publication, Sports Literature, thereby ensuring that students acquire both historical depth and contemporary relevance. Moreover, the inclusion of Ability Enhancement, Skill Enhancement, and Value-Based Education modules, in alignment with NEP 2020, equips students with ethical awareness, communicative efficacy, and cultural literacy, all rooted in the pluralistic ethos of India.

This curriculum thus not only cultivates advanced scholarship in Bengali literature but also reclaims and revitalizes India’s indigenous intellectual legacy through a rigorous, student-centric, and inclusive academic structure.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1 Total Credit 27	Semester 2 Total Credit 27	Semester 3 Total Credit 24	Semester 4 Total Credit 20
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5 Total Credit 20	**Semester 6 Total Credit 20**	**Semester 7 Total Credit 20**	**Semester 8 Total Credit 20**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

Programme Outcomes	
PO1	**Concept Building:** Students completing B.A. (Major in Bengali) Programme will be able to learn the basic concepts of Bengali Language, the history of the language and they will surely attain love and respect towards Bengali language, mostly their Mother Tongue.
PO2	**Knowledge:** After the completion of the course, the students will gain knowledge about Bengali Literature, it's vast landscape and multicultural, multi religious aspects.
PO3	**Ethical and civic responsibility:** Students will be trained to understand ethical principles and personal values, through Literature, including the ability to engage in informed and ethical decision-making.

Programme Specific Outcomes	
PSO1	**Conceptual Understanding:** Students will develop a strong conceptual foundation in Bengali literary theories, aesthetics, and cultural philosophies, enabling them to interpret texts with critical insight and connect literary expression to broader intellectual and social frameworks.
PSO2	**Broad Knowledge**: Students will gain extensive knowledge of the evolution, structure, and usage of the Bengali language, along with a deep understanding of major literary works, authors, and movements from ancient to modern periods.
PSO3	**Individuality and collaborative skills:** Students will cultivate the ability to work effectively in teams. They will develop leadership, cooperation, and conflict resolution skills.
PSO4	**Industry Relation:** In the field of literature, students can be able to critically analyse texts of various genres in literature and thus can work successfully as Teachers and Educators, Copy Editor, story writer, script writer of Television and other Medias.
PSO5	**Critical thinking and Problem solving:** Students will be able to think critically, ask questions, develop skills and solve problems through reflective thinking and logical reasoning.
PSO6	**Analytical skills:** Students will develop the ability to interpret and analyze data, texts, and other forms of information to draw meaningful conclusions.
PSO7	**Technique of Literature:** Students will get the knowledge about the technical aspects of Literature, i.e. Poetics, Figure of Speech, Idioms, Poesy etc.
PSO8	**Competencies for employment and Research:** Students will be prepared for professional careers and lifelong learning by developing self-management skills, including time management, adaptability, and goal-setting. They will acquire the skills to locate, evaluate, and use information effectively for research purposes in Social Sciences.
PSO9	**Multidisciplinary Approach:** Integrate concepts from Multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Language and Literature.
PSO10	**Communication Skills and Human values:** Written and oral communication skills of the students will be enhanced enabling them to express ideas clearly and effectively in various contexts and human values.

Mapping of Courses with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
DS1	✓	✓			✓	✓		✓		
DS2	✓	✓			✓	✓		✓		
DS3	✓	✓			✓	✓		✓		
DS4	✓	✓			✓	✓	✓	✓		
DS5	✓	✓			✓	✓	✓	✓		
DS6	✓	✓			✓	✓	✓	✓		
DS7	✓	✓			✓	✓		✓		
DS8	✓	✓			✓	✓		✓		
DS9	✓	✓			✓	✓		✓		
DS10	✓	✓			✓	✓		✓		
DS11	✓	✓			✓	✓		✓		
DS12	✓	✓			✓	✓	✓	✓		
DS13	✓	✓			✓	✓		✓		
DS14	✓	✓			✓	✓		✓		
DS15	✓	✓			✓	✓		✓		
DS16	✓	✓			✓	✓		✓		
DS17	✓	✓			✓	✓		✓		
DS18	✓	✓			✓	✓		✓		
DS19	✓	✓			✓	✓		✓		
DS20	✓	✓			✓	✓		✓		
DS21	✓	✓			✓	✓		✓		
MA1/MB1									✓	
MA2/MB2									✓	
MA3/MB3									✓	
SM1/SM2									✓	
SEC1	✓	✓	✓	✓		✓	✓	✓		
SEC2	✓	✓	✓	✓		✓	✓	✓		
SEC3									✓	
AE1										✓
AE2										✓
AE3										✓
MD1/MD2/MD3									✓	
VAC1										✓
VAC2										✓

Course Learning Outcome

MAJOR COURSES IN BENGALI (DSC – Department Specific Course)

DS-1
BNGDSC101T
প্রাচীন ও মধ্যযুগের বাংলা সাহিত্যের ইতিহাস পাঠ
Ancient & Medieval History of Bengali Literature

- **CO1: Historical Understanding:** Demonstrate an in-depth understanding of the evolution of Bengali literature from its ancient to medieval phases, identifying major texts, authors, and literary trends within their historical and cultural contexts.

- **CO2: Literary Analysis:** Critically analyze literary works from the Charyapada to the Mangalkavya and Vaishnava Padavali traditions, appreciating their linguistic, stylistic, and thematic characteristics.

- **CO3: Cultural Contextualization:** Assess the influence of religious, socio-political, and cultural movements (such as Buddhism, Vaishnavism, and Islam) on the development of medieval Bengali literary forms and narratives.

DS-2
BNGDSC202T
প্রাগাধুনিক বাংলা সাহিত্য পাঠ
(Pre-Modern Bengali Literature)

- **CO1: Historical Context and Literary Traditions:** Students will be able to identify and explain the major historical, social, and religious contexts that shaped Bengali literature from its earliest extant forms (e.g., Charyapada) up to the cusp of the modern period, and recognize the evolution of diverse literary traditions (e.g., Vaishnava Padavali, Mangalkavya) within this timeframe.

- **CO2: Analysis of Major Genres and Texts:** Students will demonstrate the ability to critically analyze representative texts from the primary genres of pre-modern Bengali literature, including lyrical poetry, narrative epics, devotional songs, and biographical narratives, discerning their thematic concerns, stylistic features, and narrative structures.

- **CO3: Linguistic and Cultural Appreciation:** Students will develop an appreciation for the linguistic nuances, archaic vocabulary, and poetic conventions of pre-modern Bengali, understanding how these elements contribute to the aesthetic and cultural value of the literature, and recognizing the interplay between literary expression and the prevailing socio-religious beliefs of the period.

DS – 3
BNGDSC303T
আধুনিক বাংলা সাহিত্যের ইতিহাস
(History of Modern Bengali Literature)

- **CO1: Periodization and Literary Movements:** Students will be able to identify and explain the major periods and defining literary movements of modern Bengali literature (e.g., Bengal Renaissance, Romanticism, Realism, Modernism, Post-Modernism), recognizing their socio-cultural contexts and representative authors.

- **CO2: Genre Evolution and Innovation:** Students will demonstrate a comprehensive understanding of how various literary genres—such as poetry, short stories, novels, and drama—evolved and innovated within modern Bengali literature, analyzing the stylistic and thematic shifts across different authors and schools of thought.

- **CO3: Thematic Analysis and Critical Perspectives:** Students will be able to critically analyze the major thematic concerns (e.g., nationalism, social reform, urban alienation, identity, existentialism) reflected in modern Bengali literary works, and engage with different critical perspectives on these texts and their historical significance.

DS – 4
BNGDSC404T
বাংলা ভাষার ইতিহাস ও ভাষাতত্ত্ব
(History of Bengali Language & Linguistics)

- **CO1: Tracing Genealogical Development:** Students will be able to trace the historical lineage of the Bengali language from its origins in Old Indo-Aryan through Middle Indo-Aryan and Apabhramsa stages, identifying the key linguistic features and sound changes that mark its evolution into an independent language.

- **CO2: Periodization and Linguistic Markers:** Students will demonstrate an in-depth understanding of the major historical periods of the Bengali language (e.g., Old Bengali, Middle Bengali, Modern Bengali), recognizing the characteristic phonological, morphological, and syntactic features that define each period.

CO3: Fundamental Linguistic Concepts: Students will demonstrate an understanding of core linguistic concepts as applied to Bengali, including phonetics, phonology, morphology, syntax, and semantics, and be able to analyze the structure and function of the Bengali language using these frameworks.

DS – 5
BNGDSC405T
সাহিত্যের রূপরীতি ও ভারতীয় সাহিত্যতত্ত্ব
Types of Literature & Indian Poetics

CO1 – This course will make the students enabled to analyse types of Literature.

CO2 – Students will be able to identify the Genre of the text they study in their curriculum.

CO3 – Indian Poetics can train them to analyse a text by various tools developed by the eminent Indian Philosophers and Literary scholars.

DS – 6
BNGDSC406T
বাংলা ছন্দ : সংজ্ঞা, বৈশিষ্ট্য, স্বরূপ নির্ণয় ও তার চর্চার ইতিহাস
Bengali Prosody

CO1 –In this course, Bengali Chhando and Alamkaras being taught to enhance the technological knowledge of a student in Bengali Poetry and Prose.
CO2 - The three types of Bangla Chhando is the main pillar of Bengali poetry. So, after the completion of this course, a student can analyse the form of a Bengali poetry in a right manner.
CO3 – A study in the history of Bengali Prosody may enable the students to determine the development of the theory of Bengali Prosody.

DS – 7
BNGDSC407T
বাংলা কাব্য ও কবিতা
Bengali Poetry

CO1: Critical Appreciation: Students will be able to critically analyze and interpret a diverse range of Bengali poems from various periods and literary movements, identifying key themes, stylistic devices, and socio-historical contexts.

CO2: Poetic Forms and Techniques: Students will demonstrate an in-depth understanding of the evolution and characteristics of major Bengali poetic forms (e.g., sonnet, ghazal, blank verse, free verse) and recognize the application of poetic techniques such as imagery, metaphor, symbolism, and prosody.

CO3: Contextual Understanding: Students will be able to situate Bengali poetry within its broader literary tradition and intellectual landscape, identifying the influences of other literary movements and philosophical thoughts on Bengali poets and their works.

DS – 8
BNGDSC508T
মধ্যযুগের বাংলা সাহিত্য পাঠ
Study of Bengali Medieval Literature

- **CO1: Historical and Thematic Understanding:** Students will be able to identify and explain the major historical, social, and religious contexts that shaped Bengali medieval literature, and analyze the recurring themes and motifs prevalent in the literary works of this period (e.g., devotionalism, epic narratives, social commentary).

- **CO2: Genre Recognition and Analysis:** Students will demonstrate a comprehensive understanding of the characteristics and evolution of key literary genres within Bengali medieval literature, including Mangalkavya, Vaishnava Padavali, Charyapada, and biographical narratives, and critically analyze representative texts from each genre.

- **CO3: Linguistic and Stylistic Appreciation:** Students will develop an appreciation for the linguistic and stylistic features of medieval Bengali, recognizing the archaic vocabulary, grammatical structures, and poetic conventions unique to the period, and discussing their impact on the overall literary expression.

DS – 9
BNGDSC509T
বাংলা গদ্য ও প্রবন্ধপাঠ
Study of Bengali Prose & Essay

- **O1: Evolution and Diversification of Prose:** Students will be able to trace the historical development of Bengali prose from its early forms to modern variations, identifying key figures and seminal works that shaped its evolution, and recognizing the diversification of prose into various genres such as essays, short stories, and novels.

- **CO2: Analytical and Critical Reading of Essays:** Students will demonstrate the ability to critically analyze and interpret Bengali essays from different periods, discerning the authors' arguments, rhetorical strategies, and underlying philosophical or social perspectives, and evaluating their effectiveness and impact.

- **CO3: Stylistic Appreciation and Thematic Understanding:** Students will develop an appreciation for the distinct stylistic features of different Bengali prose writers, identifying their unique narrative techniques, use of language, and thematic concerns, and understanding how these elements contribute to the overall meaning and aesthetic value of their works.

DS – 10
BNGDSC510T
বাংলা নাটক ও রঙ্গমঞ্চের ইতিহাস পাঠ
Bengali Drama & Histry of Bengali Stage

- **CO1: Historical Trajectory and Evolution:** Students will be able to trace the historical development of Bengali drama from its origins to contemporary forms, identifying key periods, influential playwrights, and major theatrical movements that shaped the Bengali stage.

- **CO2: Dramatic Analysis and Theatrical Elements:** Students will demonstrate the ability to critically analyze various Bengali plays, identifying their thematic concerns, character development, plot structures, and dialogue, and understanding how these elements interact with the staging conventions and performance practices of the Bengali theatre.

- **CO3: Stagecraft and Socio-Cultural Context:** Students will develop an understanding of the relationship between Bengali drama and its socio-cultural context, recognizing how historical events, social changes, and intellectual currents have influenced both the content of plays and the evolution of stagecraft and performance styles on the Bengali stage.

DS – 11
BNGDSC511T
বাংলা জীবনী সাহিত্য পাঠ
Study of Bengali Biography & Autobiography

- **CO1: Genre Definition and Evolution:** Students will be able to define the distinct characteristics of Bengali biography and autobiography as literary genres, tracing their historical development from early forms to modern interpretations, and identifying key textual conventions unique to each.

- **CO2: Critical Analysis of Life Narratives:** Students will demonstrate the ability to critically analyze representative Bengali biographies and autobiographies, examining the construction of the subject's life, the author's narrative strategies, the interplay of personal and public spheres, and the reflection of socio-historical contexts within these narratives.

- **CO3: Thematic Exploration and Ethical Considerations:** Students will identify and discuss recurring themes within Bengali biographical and autobiographical writings, such as self-representation, memory, identity, social commentary, and historical documentation, while also exploring the ethical considerations involved in presenting a life narrative.

DS - 12
BNGDSC612T
বাংলা অলঙ্কার পাঠ
Bengali Rhetoric

- **CO1: Understanding Key Concepts of Rhetoric**
    - Demonstrate an understanding of classical and modern theories of rhetoric in Bengali literature and oratory.

- Identify and explain the key rhetorical devices used in Bengali texts, such as metaphor, simile, alliteration, antithesis, and irony.

- **CO2: Analyzing Rhetorical Techniques in Bengali Literature**

  - Critically analyze the use of rhetorical techniques in Bengali literary works, including poetry, prose, and drama.
  - Evaluate the effectiveness of rhetorical devices in shaping the tone, mood, and meaning of Bengali texts.

DS -13
BNGDSC613T
বাংলা উপন্যাস পাঠ
Study of Bengali Novel

- **CO1: Understanding the Evolution of Bengali Novel**

  - Demonstrate a comprehensive understanding of the evolution of the Bengali novel, from its inception in the 19th century to the modernist transformations in the 20th century.
  - Identify the major historical, cultural, and social factors that influenced the development of the Bengali novel, including colonialism, nationalism, and socio-economic changes.

- **CO2: Analyzing Themes and Narrative Techniques**

  - Critically analyze the key themes in the novels of Bankimchandra, Saratchandra, Tarasankar, and Manik, such as nationalism, identity, social reform, human emotions, and socio-political struggles.
  - Explore the narrative styles and techniques used by these authors, including their use of symbolism, characterization, and plot structure to convey deeper philosophical and moral messages.

CO3: Comparative Study of Bengali Novelists

- Compare and contrast the approaches of these four novelists to the portrayal of themes such as nationalism, love, family, and societal tensions.

DS - 14
BNGDSC614T
বাংলা ছোটগল্প পাঠ
Study of Bengali Short Stories

- **CO1: Understanding the Evolution of Bengali Short Story**

  - Understanding of the historical development of the Bengali short story from its early forms in the 19th century to the modernist and postmodernist periods.
  - Trace the influence of socio-political movements, literary trends (e.g., Romanticism, Realism, Modernism), and the impact of colonial and post-colonial contexts on the evolution of Bengali short stories.

- **CO2: Analyzing Key Themes in Bengali Short Stories**

- Identify and analyze recurring themes in Bengali short stories, including but not limited to, social issues (poverty, caste, gender, etc.), love, betrayal, family dynamics, existential questions, and the human condition.

- **CO3: Understanding the Literary Style and Techniques**

  - Critically engage with the literary style, narrative techniques, and structural elements of Bengali short stories.

DS -15
BNGDSC615T
রবীন্দ্রসাহিত্য পাঠ

Study of Tagore's Literature

• **CO1 : Critical Analysis of Key Literary Works**: Students will demonstrate an in-depth understanding and critical analysis of Rabindranath Tagore's major works, including his novel *Shesher Kobita*, autobiography, and letters, focusing on themes such as modernity, humanism, and the complexities of personal and social identities.

• **CO2** : **Contextual Understanding of Tagore's Philosophical and Literary Evolution**: Students will explore the evolution of Tagore's literary style and philosophical outlook, connecting his personal life, social reform ideas, and engagement with national and international movements to the themes presented in his works, particularly in his autobiographical writings and letters.

•**CO3 : Interpretation of Tagore's Legacy in Contemporary Literature**: Students will critically evaluate the relevance and influence of Tagore's ideas in the context of contemporary global literature, drawing connections between his vision of society and the literary landscape today.

DS - 16
BNGDSC616T
সংস্কৃত, ইংরেজি, হিন্দি ও অসমিয়া সাহিত্যের ইতিহাস

History of Sanskrit, English, Hindi & Ashamia Literature

• CO1 : **Comprehensive Literary History**: Students will identify and explain the major periods, movements, and key authors in the historical development of Sanskrit, English, Hindi, and Assamese literature.

• CO2 : **Comparative Literary Analysis**: Students will compare and contrast the thematic and stylistic evolution of the four literatures, highlighting cultural and historical influences across linguistic traditions.

• CO3 : **Critical Understanding of Literary Contexts**: Students will analyze how socio-political, religious, and philosophical contexts shaped the development of each literature and contributed to the formation of regional and national literary identities.

DS-17
BNGDSC717T
প্রতিবেশি সাহিত্যের বাংলা অনুবাদ পাঠ

Study of Neighbour Language Literature

• CO1 : **Familiarity with Regional Literatures**: Students will gain foundational knowledge of the literary history, major genres, and representative works of neighbouring language literatures such as Hindi, Kannada, and Malayalam.

CO2 : **Cross-Cultural Literary Appreciation**: Students will develop an appreciation for the cultural diversity and thematic richness reflected in the literatures of neighbouring Indian languages.

- CO3 : **Analytical and Comparative Skills**: Students will critically analyze selected texts and draw connections between their own literary traditions and those of neighbouring languages, fostering inter-linguistic and inter-cultural understanding.

DS - 18
BNGDSC818T
বাংলাদেশের বাংলা সাহিত্য পাঠ

Study of Bangladeshi Bengali Literature

- CO1: **Understanding of Literary Forms and Movements**: Students will identify and analyze key developments in Bangladeshi Bengali literature, including major works in the novel, poetry, and drama, within their historical and cultural contexts.

- CO2 : **Critical Engagement with Texts**: Students will critically examine themes such as nationalism, identity, social change, and liberation in representative Bangladeshi literary texts across genres.

- CO3: **Appreciation of Literary Diversity**: Students will develop an informed appreciation of the stylistic and thematic diversity in Bangladeshi Bengali literature, recognizing its distinct contributions to the broader Bengali literary tradition.

DS – 19
BNGDSC819T
নারী প্রগতিমূলক বাংলা সাহিত্য পাঠ

Study of Bengali Literature on Women Emancipation

- CO1: **Critical Understanding of Gender Representation**: Students will analyze how works like *Birangana Kabya*, *Sitayan*, and *Amar Jibon* portray the struggles, voices, and agency of women in different historical and literary contexts.

- CO2 : **Exploration of Feminist Perspectives**: Students will examine the evolution of feminist thought in Bengali literature, assessing how these texts challenge traditional gender roles and advocate for women's emancipation.

- CO3 : **Contextual Literary Analysis**: Students will interpret the selected texts in relation to their socio-cultural backgrounds, understanding how literature reflects and influences women's roles in society and the broader movement for gender equality.

DS – 20
BNGDSC820T
বাংলা কথাসাহিত্য পাঠ : মন্বন্তর, দাঙ্গা ও দেশভাগ

Study of Bengali Fiction: Famine, Riot and Partition

- CO1: **Historical and Literary Insight**: Students will analyze how Bengali fiction, including novels like *Ashani Sanket* and *Agunpakhi*, represents the human experience of famine, communal riots, and the Partition of Bengal.

- CO2 : **Critical Thematic Analysis**: Students will critically engage with themes of displacement, trauma, survival, and identity as depicted in literary narratives shaped by socio-political upheavals.

• CO3: **Understanding Literature as Social Commentary**: Students will evaluate how Bengali fiction serves as a powerful medium for documenting and critiquing historical crises and their impact on individual lives and collective memory.

DS - 21
BNGDSC821T
ভ্রমণ সাহিত্য পাঠ

CO1: **Study of Travel Literature** **Understanding of Genre and Form**: Students will identify the key features, styles, and evolution of travel literature as a distinct literary genre across cultures and periods.

• CO2: **Critical Analysis of Travel Narratives**: Students will analyze travel texts to explore themes such as identity, cultural encounter, colonialism, and self-discovery.

• CO3: **Appreciation of Cultural Perspectives**: Students will develop an appreciation for diverse worldviews by examining how travel literature represents places, peoples, and experiences from both insider and outsider perspectives.

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
BNGSEC101T/BNGSEC303T
Cinema and Bengali Literature
চলচ্চিত্র ও বাংলা সাহিত্য

CO1: Ray's Cinematic Reflections - Examine Satyajit Ray's essays on cinema and literature to understand his critical perspectives on adaptation, visual storytelling, and literary influence in film.

CO2: Theory and Critique - Evaluate Dhiman Dasgupta's contributions to Bengali film theory and criticism, focusing on his analysis of cinematic language and its literary interrelations.

CO3: Literature to Screen - Explore Chandi Mukhopadhyay's insights on literary adaptations in Bengali cinema, assessing the transformation of narrative and character from text to film.

SE-2
BNGSEC202T
Bengali Sports Literature
ক্রীড়া বিষয়ক বাংলা সাহিত্য

CO1: Sports and Social Mobility - Analyze how Moti Nandi portrays themes of struggle, resilience, and social mobility through sports narratives in novels like Koni and Kolabati.

CO2: Character and Motivation - Interpret the psychological depth and ethical challenges faced by athletes in Moti Nandi's fiction, focusing on character development and internal conflicts.

CO3: Genre and Realism in Sports Fiction - Evaluate the narrative style, realism, and socio-political undertones of Bengali sports literature, with special emphasis on Nandi's contribution to the genre.

ABILITY ENHANCEMENT COURSE (AEC)

AE-1
BNGAEC101T
Bengali Pronunciation and General Bengali Practical Spelling
বাংলা ভাষা উচ্চারণ ও সাধারণ ব্যবহারিক বানান চর্চা

CO1: Phonetic Accuracy in Bengali - Demonstrate correct pronunciation of standard Bengali sounds, with attention to regional variations and phonological rules.

CO2: Practical Spelling Skills - Apply standard Bengali spelling conventions in reading and writing, recognizing common errors and learning correction strategies.

CO3: Learning through Sahaj Path - Analyze and utilize Rabindranath Tagore's 'Sahaj Path' as a foundational tool for intuitive learning of pronunciation, vocabulary, and spelling.

AE-2
BNGAEC202T
Printing and Publishing
মুদ্রণশিল্প ও প্রকাশনা

CO1: Fundamentals of Publishing - Understand the historical development and contemporary structure of the Bengali printing and publishing industry, including key stages from manuscript to print.

CO2: Proofreading and Editing Skills - Demonstrate proficiency in Bengali proofreading, copyediting, and error correction, with a focus on accuracy, grammar, and typographic consistency.

CO3: Bengali Typing and Layout Techniques - Apply practical skills in Bengali typing using digital tools and prepare text for publication with basic knowledge of typesetting and page layout software.

For UG NEP2020 syllabus of Bengali in West Bengal State University click link bellow: https://wbsu.ac.in/web/nep-syllabus/

Program and Course Learning outcome of Undergraduate and Post Graduate course

Department of Botany

BIDHANNAGAR COLLEGE
SALT LAKE

INTRODUCTION

The B.Sc. Major in Botany under the NEP 2020 curriculum at West Bengal State University is a comprehensive four-year honours program that immerses students in the scientific study of plant life, its diversity, structure, function, evolution, and ecological significance. Designed in alignment with NEP 2020's multidisciplinary and learner-centric approach, the syllabus blends core theoretical modules—such as plant taxonomy, physiology, biochemistry, genetics, and developmental biology—with hands-on laboratory work, field excursions, and research-based projects. Students also benefit from an integrated study of related disciplines like microbiology, biotechnology, environmental science, and bioinformatics, enriching their understanding of plants in natural and applied contexts. The curriculum emphasizes practical skills development through regular lab experiments, herbarium exercises, molecular techniques, agro-botanical surveys, and industry visits. Coursework is complemented by seminars, workshops, and collaborative projects, fostering analytical thinking, scientific communication, ethical research practices, and digital competency—all key NEP 2020 objectives. With guidance from experienced faculty and researchers, students explore contemporary topics including plant conservation, sustainable agriculture, plant–microbe interactions, and climate-resilient flora. This rigorous yet flexible program aims to nurture critical reasoning and research aptitude, equipping graduates for diverse career paths in academia, research institutes, agriculture, forestry, biotechnology, environmental consultancy, and allied industries, as well as laying a solid foundation for advanced studies in plant sciences and interdisciplinary fields.

The M.Sc. course in Botany at Bidhannagar College is a two-year, full-time postgraduate program structured under the CBCS syllabus, designed to provide in-depth knowledge and advanced practical skills in plant sciences through a blend of theory, laboratory work, and research-oriented activities. The curriculum encompasses key areas such as microbiology, phycology, plant anatomy, genetics, physiology, taxonomy of angiosperms, mycology, plant pathology, and biotechnology, ensuring students gain a comprehensive understanding of plant diversity, structure, function, and evolution. The laboratories classes support hands-on training in biochemistry, genetics, and general plant sciences, fostering analytical and experimental skills essential for scientific inquiry and innovation. Upon completion, graduates are expected to demonstrate proficiency in identifying and classifying plants, understanding their ecological and economic significance, and applying biotechnological tools for research and industry needs. The course outcomes emphasize the development of scientific reasoning, critical thinking, and the ability to conduct independent research, preparing students for careers in academia, research institutions, environmental consultancies, and the biotechnology sector, as well as for pursuing higher studies and contributing to sustainable development and biodiversity conservation.

Program and Course Learning outcome of Undergraduate course

Course offered in Undergraduate Program

Semester 1 Total Credit 27	**Semester 2 Total Credit 27**	**Semester 3 Total Credit 24**	**Semester 4 Total Credit 20**
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5 Total Credit 20	**Semester 6 Total Credit 20**	**Semester 7 Total Credit 20**	**Semester 8 Total Credit 20**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOMES	
PO1	Students will acquire the knowledge about diversity of plants and microbes their habitat, morphology, and reproduction, genetics and molecular biology, physico chemical properties, their Industrial, medicinal and Agricultural implications also environmental dynamics, biotic interactions, pollution, conservation.
PO2	Hands on Training on different lab-based techniques will enable students to develop skills and proper understanding of the subject and explore its applicability.
PO3	Students will be able to appreciate the importance of plant science and would be able to apply the acquired knowledge to adopt their future profession.

PROGRAMME SPECIFIC OUTCOME	
PSO1:	Demonstrate disciplinary knowledge of different areas of Botany starting from simplest life forms like bacteria to most advanced angiosperms along with their origin, morphology, anatomy, taxonomy, cell biology, molecular biology, physiology, biochemistry, ecology, diseases, along with their analytical techniques, bioinformatics and various other branches.
PSO2:	Analyse different aspects of disciplinary knowledge and show critical thinking on the subject.
PSO3:	Demonstrate experimental proficiency in Botany and develop skill in using scientific equipment's related to plant science.
PSO4:	Work in team through group activities, field trips and departmental events.
PSO5:	Demonstrate digital proficiency in preparing project report and use of basic biostatical and bioinformatic tools
PSO6:	Communicate confidently their subject related knowledge, findings, observations or views through presentations in seminars and through writing
PSO7:	Learn to undertake discipline related research through project work and dissertation.
PSO8:	Show moral and ethical behaviour in accurate data presentation, maintaining bio safety in the laboratory, avoiding plagiarism and adopting moral practice in all activities.
PSO9:	Apply knowledge gathered during the course to address different issues of society and environment by encouraging, sustainable development, scientific temperament.
PSO10	Integrate concepts and understanding from Multidisciplinary subjects to enhance their knowledgebase and to apply them in various field of plant science and expand job opportunities
PSO11	Develop communicative skill and nurture human values.

PO-CO Mapping

Courses	Programme specific Outcomes (PSO)										
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11
DSC-1	√	√	√			√	√		√		
DSC-2	√	√	√			√	√		√		
DSC-3	√	√		√		√	√		√		
DSC-4	√	√		√		√			√		
DSC-5	√	√		√		√	√		√		
DSC-6	√	√				√	√		√		
DSC-7	√	√		√	√	√	√		√		
DSC-8	√			√	√		√		√		
DSC-9	√	√			√	√	√		√		
DSC-10	√	√	√		√	√			√		
DSC-11	√	√			√	√	√		√		
DSC-12	√	√	√			√	√		√		
DSC-13	√	√	√			√	√		√		
DSC-14	√	√	√		√	√	√	√	√		
DSC-15	√		√		√	√		√	√		
MA-1/MB-1										√	
MA-2/MB-2										√	
MA-3/MB-3										√	
SM-1/SM-2										√	
AE-1											√
AE-2											√
AE-3											√
SE-1	√		√	√							
SE-2	√		√	√							
SE-3										√	
MD1/MD2/MD3										√	
VA-1											√
VA-2											√

Course outcome or Learning outcome

DEPARTMENT SPECIFIC COURSES (DSC)

DS-1
BOTDSC101T & BOTDSC101P
Microbiology and Phycology

After successful completion of theoretical and practical courses students will be able to understand –

1. Microbial world, microbiology as a discipline, contribution of several microbiologists.
2. Physiochemical and biological characteristics, structural properties of Viruses, including subviral particles, lytic and lysogenic cycle.
3. General characteristics, types, nutrition, growth and metabolism of Bacteria, Vegetative, asexual reproduction and recombination (conjugation, transformation and transduction).
4. Bioreactors/Fermenters and fermentation processes, downstream processing and industrial production of ethanol, penicillin, citric acid and amylase, importance of bacteria in agriculture, sewage, domestic waste water system and role of viruses in vaccines.
5. General characteristics, ecology and distribution, range of thallus organization, cell structure and components, cell wall, pigment system, reserve food, methods of reproduction, classification, criteria, evolution of sex in algae.
6. Characteristics, occurrence, range of thallus organization, cell structure, reproduction, Economic importance, and life-cycles pattern in Cyanophyta and Xanthophyta, Chlorophyta and Charophyta, Bacillariophyta, Phaeophyta and Rhodophyta.
7. Role of algae in environment, agriculture, biotechnology, biofuels, industry and bioremediation.
8. Through practical classes students would have working experience of preparation of media, sterilization and sub culturing, Gram staining of bacteria from curd sample, Endospore staining with malachite green, Isolation of bacteria from soil, water and air; Isolation of antibiotic producing microbes from soil; Determination of BOD, COD, TDS and TOC of water sample, characterization of Alga through temporary slide preparation.

DS-2
BOTDSC202T & BOTDSC202P
Mycology Phytopathology

After successful completion of theoretical and practical courses students will be able to understand –

1. General characteristics, systematics, thallus organization; cell wall composition; nutrition; sexual and asexual reproduction, classification, Concepts of Molecular identification.
2. Characteristic features; ecology and significance; thallus organisation; reproduction; life cycle pattern in Chytridiomycota and Zygomycota, Ascomycota and Basidiomycota with reference of few examples.
3. General characteristics, plasmodia, fruiting bodies of Slime molds, General characteristics; ecology; life cycle and classification of Oomycota.
4. Symbiotic associations, Mycorrhiza, Occurrence, general characteristics, growth forms, thallus organization, ecological and economic significance of Lichens.
5. Role of fungi in biotechnology; application of fungi in food industry, agriculture; mycotoxins, biological control, medical mycology.
6. Definitions and Concepts of plant disease, symptoms, disease types, disease triangle, disease cycle, Koch's Postulates.
7. Host - Parasite Interaction, Disease development, Defence strategies, Roles of Phytoalexins, Phytoanticipins & PR proteins, elicitors, HR response, Resistance – systemic acquired and induced systemic resistance.
8. Disease Management, quarantine; disease diagnosis; Casual organism, disease cycle and management of few bacterial viral and Fungal and Oomycete diseases; Plant disease epidemiology, basic concepts, elements of disease, disease forecasting, Plant pathologist's contribution to crops and society.
9. Through practical classes students would have working experience of study of vegetative and reproductive structures of different fungus, study of various plant diseases from herbarium

specimens and Isolation of pathogen from diseased leaf, inoculation of fruit, demonstration of media preparation, pure culture isolation.

DS-3

BOTDSC303T & BOTDSC303P

Archegoniatae I [Bryophytes, Pteridophytes]

After successful completion of theoretical and practical courses students will be able to understand –

1. General features of archegoniates, General characteristics, range of thallus organization adaptations to land habit; classification of Bryophytes.
2. Systematic position, morphology, anatomy and reproduction of few Bryophytes, evolutionary trends in Bryophytes.
3. Ecological and economic importance of bryophytes; Bryophyte as pollution indicator, Model plant - *Physcomitrium patens*.
4. General characteristics, classification, phylogeny of Pteridophytes, early land plants.
5. Systematic position, morphology, anatomy and reproduction of few representative Pteridophytes.
6. Apogamy and apospory, Heterospory and origin of seed habit, telome theory, stelar evolution; ecological and economic importance; fern gametophyte and sporophyte culture and uses; Model plant *Ceratopteris*.
7. After practical courses students will be able to study the vegetative and reproductive structures of different Bryophytes and Pteridophytes.

DS-4

BOTDSC404T & BOTDSC404P

Archegoniatae II [Gymnosperms, Paleobotany, Palynology]

After successful completion of theoretical and practical courses students will be able to understand –

1. General characteristics, classification, of Gymnosperms; morphology, anatomy and reproduction of some Gymnosperms; ecological and economic importance; evolutionary significance, with special reference to progymnospermopsida, Lyginopteridales, Cordaitales, Glossopteridales and Bennetitales.
2. Fossils, Types and mode of preservation, conditions for fossilization; Geological time scale and major events of plant life through geological ages, principles of fossil dating
3. Gondwana land, Indian Gondwana system, major divisions with major mega fossil assemblages; Plate-tectonic movement, continental drift theory.
4. Spore and pollen; polarity, symmetry, shape and size, aperture types; pollen wall chemistry, stratification & ornamentation, NPC classification; Application of Palynology, Aeropalynology, Melissopalynology, Palaeopalynology and Forensic palynology.
5. After practical courses the students will be competent to study the vegetative and reproductive structure of Gymnospermous plant, pollen characteristics, fossil evidences samples.

DS-5

BOTDSC405T & BOTDSC405T

Economic Botany, Ethnobotany& Pharmacognosy

After successful completion of theoretical and practical courses students will be able to understand –

1. Origin of Cultivated Plants, Concept of centres of origin.
2. Origin, morphology, cultivation & uses of Cereals (Rice, millets), Legumes (Chick pea), sugarcane, Spices, Beverages (Tea and Coffee), oils and fats, Drug yielding plants, Timber plants (Teak, Sal), Fibre-yielding plants (Cotton, Jute, and Alied fibres).
3. Concept, scope and objectives of Ethnobotany as an interdisciplinary science; Role of ethnobotany in modern Medicine Medico-ethnobotanical sources in India, study on some ethnobotanically significant plant.
4. Ethnobotany and legal aspects, Biopiracy, Intellectual Property Rights and Traditional Knowledge.

5. Pharmacognosy - General account and importance in modern medicine; Drugs - classification evaluations (organoleptic, microscopic, chemical & physical); Bioassay of drug, drug Adulterant.
6. Secondary metabolites of plants - Primary and Secondary Metabolites; Utilization of major types of metabolites as drug - phenolics & quinones, terpenoids, flavonoids and alkaloids.
7. Active constituents: - Source plants, parts used, chemical nature & uses of some secondary metabolites, like Glycosidic anthraquinone, Tannic acid derivative, Resins, Steroids, Alkaloids.
8. After practical courses the students will be competent to evaluate crude drugs for adulteration, characterization of cultivated crops.

DS-6

BOTDSC406T & BOTDSC406T

Plant Anatomy & Embryology

After successful completion of theoretical and practical courses students will be able to understand –

1. Applications in systematics, forensics and pharmacognosy.
2. Internal organization of plant body, three tissue systems; Tissues – Classification, characteristics; cytodifferentiation of tracheary elements and sieve elements; pits and plasmodesmata, ergastic substances, hydathodes, cavities, lithocysts and laticifers.
3. Apical meristems- organization, Apical cell theory, Histogen theory, Tunica Corpus theory, Korper-Kappe theory; Vascular bundles – types, structure; structure of Dicot and monocot stem, root and leaves, Kranz anatomy.
4. Vascular Cambium - Structure, function and seasonal activity; secondary growth in root and stem, anomalous secondary growth; wood - sapwood and heartwood, ring and diffuse porous wood, early and late; periderm - development and composition.
5. Adaptive and Protective tissue Systems - Epidermal tissue system, cuticle, trichomes, stomata, adcrustation and incrustation; anatomical adaptations of xerophytes and hydrophytes.
6. Sporogenesis & Gametogenesis, Fertilization, development of endosperm; Embryo development, types; apomixis and its application, Polyembryony.
7. After practical courses students will be able to study the different types of tissue, primary and secondary structure of stem, root and leaf, with differential staining methods, study the reproductive structures including embryo sac pollen grains, dissection of embryo/endosperm from developing seeds.

DS-7

BOTDSC407T & BOTDSC407P

Morphology & Plant systematics

After successful completion of theoretical and practical courses students will be able to understand –

1. Plant morphology, inflorescence – Types and derivation; Flower – different parts and their cohesion and adhesion, placentations ; Fruits and Seeds, and their dispersal.
2. Plant systematics, plant identification, classification, nomenclature; taxonomic evidences from palynology, cytology, phytochemistry and molecular data; Roles of herbarium and botanical gardens, virtual herbarium; flora, monographs and manuals, journals; taxonomic keys.
3. Taxonomic hierarchy, species concept, Botanical nomenclature-Principles and rules (ICN); typification, author citation, valid publication, rejection of names, principle of priority and its limitations.
4. Major contributions of renowned taxonomists; Systems of classification - by Systems of classification, Engler and Prantl, angiosperm phylogeny Group (APG III) classification.
5. Numerical taxonomy and cladistics analysis, OTUs and OEUs, character weighing and coding, cluster analysis, phenograms, cladograms.
6. Phylogeny of Angiosperms- Apomrphy and Plesiomorphy, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly, origin and evolution of Angiosperms.
7. After practical courses students will be able to characterise and identify Angiospermic plants and analysis data to construct Dendrogram.

DS-8

BOTDSC508T & BOTDSC508P

Plant ecology& Phytogeography

After successful completion of theoretical and practical courses students will be able to understand –

1. Plant ecology - Basic concepts, Levels of organization, Homeostasis.
2. Soil – Origin, composition, properties, profile, development, soil profile, importance; Water – soil water, atmospheric moisture; hydrological cycle; Adaptations of plants to variations of light, temperature, wind and fire.
3. Ecosystem - biotic interactions, trophic organization, sources of energy and energy flow, production and productivity, symbiosis, commensalism, parasitism; food chains and webs, ecological pyramids.
4. Plant communities and successions, Concept of ecological amplitude; niche, ecotone; population ecology, ecological speciation.
5. Biogeochemical cycles - cycling of carbon, nitrogen and phosphorus.
6. Phytogeographical division of India (BSI 1996), endemism; major terrestrial biomes - Tropical rain forest, Temperate grassland and Tundra.
7. Through practical classes students would be able to measure microclimatic variables, carbonates, chlorides, nitrates, organic matters in soil, biotic interactions, also to carryout quantitative analysis of herbaceous vegetation, study vegetative and floral characters of few plant families.

DS-9

BOTDSC509P & BOTDSC509P

Cell Biology & Genetics

After successful completion of theoretical and practical courses students will be able to understand –

1. Prokaryotic and eukaryotic cells, origin of eukaryotic cell (Endosymbiotic theory).
2. Cell wall and plasma membrane - Chemistry, structure and function; membrane transport – passive, active and facilitated transport, endocytosis and exocytosis.
3. Structure of Nucleus, molecular organization of chromatin; nucleosome concept; Structure of nitrogenous bases, nucleotides; Nucleic acids – structure, types, types of DNA and RNA.
4. Structure and function of cytoskeleton; structural organization and function of Chloroplast, mitochondria and peroxisomes, semiautonomous nature of mitochondria and chloroplast.
5. Endomembrane system – structure and function of Endoplasmic reticulum, Golgi apparatus, lysosomes.
6. Cell division- Phases of eukaryotic cell cycle, mitosis and meiosis; regulation of cell cycle - checkpoints, role of protein kinases.
7. Mendelian genetics and deviations, principles of inheritance, chromosome theory of inheritance; autosomes and sex chromosomes; probability and pedigree analysis, extrachromosomal Inheritance.
8. Linkage, crossing over and chromosome mapping, two factor and three factor crosses, interference and coincidence, gene mapping, sex Linkage.
9. Variation in chromosome number and structure - Deletion, duplication, inversion, translocation, position effect, euploidy and aneuploidy.
10. Gene mutations, types of mutations, molecular basis of mutations; physical and chemical mutagens, detection of mutations, Role of transposons in mutation, DNA repair mechanisms.
11. Fine structure of gene, functional allelism; Population and Evolutionary Genetics, Law of probability, Genetic variation and speciation.
12. After completion of practical courses the students will be able to study chromosome applying staining technique.

DS-10

BOTDSC6010T & BOTDSC6010P

Plant Physiology

After successful completion of theoretical and practical courses students will be able to understand –

1. Plant-water relations, water absorption, water movement, symplast, apoplast, transmembrane pathways; Ascent of sap, transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement.
2. Mineral nutrition- macro and micronutrients, mineral deficiency symptoms, roles of essential elements, chelating agents.
3. Nutrient Uptake, electrochemical gradient, facilitated diffusion, active absorption, uniport, co-transport, symport, antiport.
4. Translocation in the phloem- pressure flow model, phloem loading and unloading, source- sink relationship.
5. Plant growth regulators- Discovery, chemical nature, bioassay and physiological roles of auxin, gibberellins, cytokinin, abscisic acid, ethylene; Brief account of Brassinosteroids and Jasmonic acid.
6. Physiology of flowering- Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy and germination; Phytochrome, cryptochromes and phototropins and its role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.
7. After completion of practical courses the students will be able to demonstrate and evaluate various physiological processes.

DS-11
BOTDSC5011T & BOTDSC5011P
Plant Breeding and Biostatistics

After successful completion of theoretical and practical courses students will be able to understand –

1. Plant breeding – Aims and objectives, methods; Hybridisation and heterosis, selection methods - Mass selection, Pureline selection; Bulk method and Pedigree method; Marker assisted selection (MARS), use of Male sterility.
2. Basic principles of statistical methods, Variables, collection of data, primary and secondary; Classification - tabulation and presentation of data - sampling methods.
3. Measures of central tendency - Mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co- efficient of variations, concept of ‘p’ value and its limitations.
4. Correlation -Types and methods, regression, fitting prediction, similarities and dissimilarities of correlation and regression.
5. Statistical inference – Hypothesis, student 't' test - chi square test, Calculation of F-value.
6. After the completion of Practical courses students will be able to perform statistical analysis of the experimental data.

DS-12
BOTDSC6012T & BOTDSC6012P
Molecular Biology

After successful completion of theoretical and practical courses students will be able to understand –

1. Nucleic acids & DNA as the carrier of genetic information; organization of DNA in prokaryotes, viruses, eukaryotes; mitochondrial DNA and chloroplast DNA; Chromatin - euchromatin and heterochromatin (constitutive and facultative heterochromatin).
2. The replication DNA in Prokaryotic and Eukaryotic; Chemistry of DNA synthesis (Kornberg’s discovery); bidirectional, semi conservative and semi discontinuous replication, RNA priming; various models of DNA replication, Enzymes involved in DNA replication.
3. Central dogma and adaptor hypothesis and discovery of mRNA template; Genetic and its salient features.
4. Transcription in prokaryotes and eukaryotes, transcriptional regulation in Prokaryotes and Eukaryotes, transcription factors, Gene silencing.
5. Processing and modification of RNA, Split genes-concept, Spliceosome machinery, RNA splicing, mRNA processing, RNA editing and mRNA transport.
6. Translation - various steps in protein synthesis, initiation, elongation and termination of polypeptides; post-translational modifications of proteins.

7. After completion of practical courses students will be able to isolate Plant DNA and perform estimation.

DS-13

BOTDSC6013T & BOTDSC6013P

Plant Biochemistry & Metabolism

After successful completion of theoretical and practical courses students will be able to understand –

1. Concept of metabolism- anabolic and catabolic pathways, regulation; Types and significance of chemical bonds, pH and buffers; Enzymes – Structure, holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; classification of enzymes, mechanism of enzyme action, Michaelis–Menten equation, enzyme inhibition, factors affecting enzyme activity.
2. Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP as a energy currency molecule.
3. Carbohydrates: Nomenclature, structures and classification;
4. Photosynthesis - Pigments, Photosystems, photochemical reactions, photosynthetic electron transport, photophosphorylation, photorespiration, CO_2 fixation, C3, C4, CAM pathways; factors affecting CO2 reduction; Synthesis and catabolism of sucrose and starch.
5. Carbon Oxidation- Glycolysis, fate of pyruvate, regulation of Glycolysis, TCA cycle, regulation of Glycolysis and TCA cycle, mitochondrial electron transport, oxidative phosphorylation.
6. Mechanism of ATP synthesis, chemiosmotic mechanism role of uncouplers.
7. Lipids: classification and structure, structure and functions of fatty acids, triacylglycerols, phosphoglycerides; Synthesis and breakdown of triglycerides, α and β oxidation, role gluconeogenesis in lipid mobilisation during seed germination.
8. Proteins- amino acids, primary, secondary, tertiary and quarternary structure of protein; biological roles; Nitrate assimilation, biological nitrogen fixation.
9. Mechanisms of signal transduction - Receptor-ligand interactions; G protein; second messenger concept, calcium calmodulin, MAP kinase cascade.
10. After completion of practical syllabus students will be able to carry out qualitative test for Carbohydrate, protein, fat, isolate pigments, measure photosynthetic rate under different conditions, measure enzyme activity of Nitrate reductase, lipases.

DS-14

BOTDSC6014T & BOTDSC6014P

Biotechnology & Plant Tissue Culture

After successful completion of theoretical and practical courses students will be able to understand –

1. Recombinant DNA technology, Restriction Endonucleases, Restriction mapping (linear and circular), cloning vectors.
2. Recombinant DNA, bacterial transformation and selection of recombinant clones, PCR-mediated gene cloning; gene construct; construction of genomic and cDNA libraries, screening DNA libraries, complementation, colony hybridization.
3. Methods of gene transfer- *Agrobacterium*-mediated transformation, direct gene transfer by electroporation, microinjection, Microprojectile bombardment; selection of transgenics.
4. Applications of Biotechnology in developing Pest resistant (Bt-cotton); herbicide resistant (round-up ready soybean); with improved quality traits (Golden rice), improved horticultural (Moondust carnations) plants; role of transgenics in bioremediation (Superbug), edible vaccines, industrial enzymes (aspergillase, protease, lipase), genetically engineered products; biosafety concerns.
5. Plant tissue culture - composition of media, totipotency; organogenesis, embryogenesis (somatic and zygotic); micropropagation, protoplast isolation, culture and fusion; application of tissue culture; hardening of the tissue culture raised plants for field plantation.
6. After completion of practical syllabus students will be able to prepare culture media, vitro sterilization and inoculation method with explants, Isolation of genomic DNA and its gel electrophoresis.

DS-15
BOTDSC6015T & BOTDSC6015P
Analytical techniques

After successful completion of theoretical and practical courses students will be able to understand –

1. Imaging and related techniques- Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Flow cytometry (FACS), Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy.
2. Cell fractionation- Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2 gradient, analytical centrifugation, ultracentrifugation, marker enzymes.
3. Radioisotopes -Use in biological research, auto-radiography, pulse chase experiment.
4. Spectrophotometry- Principle and its application in biological research.
5. Chromatography- Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.
6. Characterization of proteins and nucleic acids - Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis - AGE, PAGE, SDS PAGE
7. After completion of practical syllabus students will be able to understand different blotting techniques, chromatographic techniques to separate amino acids and sugars, will be able to do protein estimation, separate proteins and DNA through gel electrophoresis.

SKILL ENHANCEMENT COURSE (SEC)

SE–1/SE-3
BOTHSE101M/BOTMSE303M
Floriculture & Gardening

After completion of the course the students will be able to -

1. Understand the theoretical and practical details of nursery and gardening.
2. Select the plant species amenable for nursery and gardening.
3. Develop their own nursery for livelihood and marketing purposes.
4. To acquire basic skill needed to design and lay gardens.

SE-2
BOTHSE202M
Tissue Culture technique and Micropropagation

After completion of the course the students will be able to -

1. Achieve basic knowledge on tissue cultural practices and will be provided with applied training.
2. Achieve proper understanding for development of skills for a successful career.
3. Acquire skill to develop their own nursery for livelihood and marketing purposes.

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3
BOTGMD202T
Biotechnological application in Agriculture

After completion of the course the students will be able to –

1. Understand the scientific basis for genetic engineering and application in agriculture.
2. Become familiar with various applications of genetic engineering in Agriculture – their purposes uses and examine the impacts on environment, health, social and ethical concerns, and controversies associated with the uses of genetically engineered product in Agriculture.
3. Critically evaluate information and logic underlying opposing point of view.

Post Graduate Program and Course Learning outcome

Courses offered

Semester 1	Semester 2	Semester 3	Semester 4
Departmental 1, Departmental 2, Departmental 3, Departmental 4, Departmental 5, AECC	Departmental 6, Departmental 7, Departmental 8, Departmental 9, Departmental 10, SEC-1	Departmental 11, Departmental 12, Departmental 13, Departmental 14, Departmental 15, GEC-1	Departmental 16, Departmental 17, Departmental 18(P), Departmental 19(P), Departmental 20(P)

PROGRAMME OUTCOMES	
PO1:	**In-depth knowledge**: Understand the concepts and processes related to an academic field of study and demonstrate the applicability of their domain knowledge and its links to related disciplinary areas/subjects of study.
PO2:	**Analytical and critical thinking:** Demonstrate independent learning, analytical and critical thinking of a wide range of ideas and complex problems and issues.
PO3:	**Research-related skills:** A sense of inquiry and development of innovative ideas, capability for asking relevant, ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate results, evidence and experiences, independent thinking, exploration of interdisciplinary areas of research
PO4:	**Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally
PO5:	**Career development:** Attainment of proficiency in academic, professional, soft skills and employability required for higher studies as well as placements

PROGRAM SPECIFIC OUTCOMES	
PSO1:	Plant diversity – gain a comprehensive understanding of the range of plant diversity, including structure, classification, function, developmental biology, ecology and environmental relationship, as well as have understanding of statistical analysis and Bioinformatics.
PSO2:	Critical thinking – analyse different aspects of disciplinary knowledge and demonstrate critical thinking on the subject.
PSO3:	Knowledge assimilation, Logical reasoning – develop the ability to think logically and organize tasks systematically.
PSO4:	Acquire practical skill and domain specific knowledge, become familiar with modern techniques in plant science, such as molecular biological techniques and bioinformatics, would be able to exhibit proficiency in using scientific equipment related to plant science and conducting experiments.
PSO5:	Communication skills – communicate subject related knowledge, findings, and observations confidently through presentations and written reports.
PSO6:	Research skills – formulate research problem, review literature, conduct, and report on independent research projects.
PSO7:	Be well-prepared for national level competitive exams (e.g. CSIR-NET, GATE, SET etc.) and international opportunities for higher education and research.
PSO8:	Research ethics – demonstrate ethical behaviour in research, including accurate data presentation, biosafety, and avoiding plagiarism.
PSO9:	Addressing societal and environmental challenges – Applying the acquired knowledge to address various issues related to society and the environment, encouraging sustainable development and scientific temperament, according to the curriculum framework.
PSO10:	Team-work – develop the ability to work effectively in teams through group activities, field trips, and departmental events.

PO-CO MAPPING

COs	Programme specific Outcomes (PSOs)									
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
Dept. 1 (BOTPCOR01T)	√		√	√	√		√			√
Dept. 2 (BOTPCOR02T)	√	√			√		√		√	√
Dept. 3 (BOTPCOR03T)	√	√			√		√		√	
Dept. 4 (BOTPCOR04T)		√	√		√		√		√	
Dept. 5 (BOTPCOR05P)	√	√	√	√	√	√	√			
AECC					√	√		√		
Dept. 6 (BOTPCOR06T)	√	√	√	√	√	√	√			√
Dept. 7 (BOTPCOR07T)	√	√	√		√	√	√		√	√
Dept. 8 (BOTPCOR08T)		√	√		√	√	√			√
Dept. 9 (BOTPCOR09T)	√	√			√		√			√
Dept. 10 (BOTPCOR010P)			√	√	√		√			√
SEC -1 (BOTPSEC01T)	√	√					√		√	√
Dept. 11 (BOTPCOR011T)		√	√	√	√	√	√			
Dept. 12 (BOTPCOR012T)		√	√		√	√	√			
Dept. 13 (BOTPDSE01T)	√	√			√		√		√	
Dept. 14 (BOTPCOR14P)			√	√	√	√	√			
Dept. 15 (BOTPCOR15P)			√	√	√	√	√			
GEC 1 (BOTPGEC01T)								√	√	
Dept. 16 (BOTPDSE02T)		√	√	√	√	√	√			
Dept. 17 (BOTPDSE03T)		√	√	√	√	√	√			
Dept. 18(P) (BOTPCOR18P)			√	√	√	√				√
Dept. 19(P) (BOTPCOR19P)			√		√	√				
Dept. 20 (BOTPCOR20P)			√		√	√		√		

COURSE LEARNING OUTCOME

CORE COURSES & DEPARTMENT SPECIFIC ELECTIVE COURSES

Departmental 1
(BOTPCOR01T)
Integrated Life sciences (ILS)

After successful completion of theoretical and practical courses students will be able to understand –

1. The basic aspects of life science as a whole.
2. The basics of the common arenas of life science such as cell structure, function, cell signalling, cancer biology, immunology, developmental biology, molecular biological techniques, Mendelian genetics and basic biostatistics.
3. It is a very preliminary course. The students will be able to follow and understand the other harder courses in the later part of Semester.

Departmental 2
(BOTPCOR02T)
Diversity of Plant life – Algae & Bryophytes

After successful completion of theoretical and practical courses students will be able to understand –

1. The diversity of the major life forms of Algae, and Bryophytes.
2. The biology, genetic structure, phylogeny, interrelationships of different members.
3. The role of algae and Bryophytes in ecological and environmental aspects, also in commercial uses.

Departmental 3
(BOTPCOR03T)
Fungal & Oomycete Biology

After successful completion of theoretical and practical courses students will be able to understand –

1. Fungi and Oomycetes are among the most important eukaryotic microbes on earth.
2. Fungi playing major roles in ecosystem process, from the degradation of organic matter and nutrient cycling to plant symbiosis and as pathogens of plants, animals, and humans.
3. Oomycetes as among the most diverse and widespread group of parasites in terrestrial and aquatic habitats. Parasitic lifecycles occur throughout the oomycete phylogent, with hosts ranging from plants, invertebrates, and vertebrates to fungi, algae, and other animals.
4. Fungi and Oomycetes as the most destructive pathogens of plants and a central role played in the development of plant pathology as a discipline.

Departmental 4
(BOTPCOR04T)
Plant Viruses & Bacteria

After successful completion of theoretical and practical courses students will be able to –

1. Understand the general structure and function of the prokaryote, microbial growth, and different microbial growth controlling factors and about the different types of culture media, the role of microorganisms in food and pharmaceutical industry, their sources, method of disinfection, sterilization and preservation of food and pharmaceutical formulation.

2. Understand microbial genetics and the different diseases caused by the plant bacteria and their control.
3. Understand the architecture of viruses, their classification and the methods used in their study.
4. Understand general replication strategies of viruses, their intricate interaction between viruses and host cells.
5. Comprehend the role of viruses for the development of virus-resistant plants.
6. Comprehend the plant viruses that can be used as tool to study biological processes, such as cloning vectors and for gene transfer.
7. Comprehend the different assay and purification techniques of the plant viruses.

Departmental 5
(BOTPCOR05P)
Laboratory Course

After successful completion of theoretical and practical courses students will be able to –

1. Understand the diversity of Algae, Bryophytes, Fungi, Oomycetes, bacteria and Viruses in various habitats, their identification using both morphological and modern molecular techniques including the use of phylogenetic softwares.
2. Get acquainted with various commonly used molecular biology techniques in plant sciences.

Departmental 6
(BOTPCOR06T)
Angiosperm systematics

The course will equip the students to -

1. Understand the origin and diversification of flowering plants.
2. Understand the advanced aspects of the principles of taxonomy (identification, nomenclature, classification of flowering plant), evolution (speciation, reproductive biology, adaptation, convergence, biogeography), and phylogenetics (phenetics, cladistics, morphology and molecules).
3. Do systematic survey of plant families, understand the evolutionary processes and patterns in the major families, and develop expertise on the representative families and local flora.

Departmental 7
(BOTPCOR07T)
Plant Ecology and Environmental biology

After successful completion of theoretical and practical courses students will be able to understand –

1. The issues of plant ecology, environment, and environmental interaction.
2. The interspecies competition, resilience study, biodiversity assessment, themes of conservation based on ecology.
3. Art knowledge about ecology and environment.

Departmental 8
(BOTPCOR08T)
Plant Pathology & crop protection

After successful completion of theoretical and practical courses students will be able to understand –

1. The importance of disease caused by representative pathogens.
2. Molecular mechanism of host-pathogen interaction and disease resistance and its translational use for the development of disease resistant plants through genetic engineering.

3. Identification of the disease based on the symptoms and their control measures.
4. The disease control strategies with special reference to principles of plant viral disease management.

Departmental 9
(BOTPCOR09T)
Diversity of plant life – Pteridophytes, Gymnosperms, Paleobotany & Palynology

After successful completion of theoretical and practical courses students will be able to understand –

1. The diversity of the major life forms of Pteridophytes and Gymnosperms as well as their fossil members.
2. The biology, phylogeny, interrelationships, role in environment, as well as commercial uses and industrial application of Pteridophytes and Gymnosperms.
3. The evolutionary interrelationship between these groups and angiosperms both from extant and extinct genera.

Departmental 10
(BOTPCOR10T)
Laboratory course

Students will be equipped to –

1. Handle and analyse plant and diseased materials in the laboratory/herbarium and in the field.
2. Use scientific terminology accurately through effective oral and written communication and the use of dichotomous keys in a regional floristic manual.
3. Have expertise in techniques related to plant pathology.
4. Have exposures to the diversity of Pteridophytes, Gymnosperms, plant fossils and palynological samples and as well as their handling techniques.

Departmental 11
(BOTPCOR011T)
Molecular & Cellular Genetics & plant breeding

After successful completion of the course the students will have -

1. Proper understanding of central principles and fundamental mechanism for the organization, replication, expression, variation, and evolution of the genetic material at molecular level as well as on methods for molecular genetic analyses and gene technology.
2. Understanding of modern concept of gene, methods to study them, along with their model systems, their changes in frequency and structure as well as its regulation.
3. Understanding of transmission genetics (including linkage analysis), quantitative genetics, and population genetics.
4. An in-depth exposure and analysis of various modern tools and instrumentation techniques used in molecular biology, cytogenetics, and plant breeding.
5. Skills necessary for critically reviewing scientific papers and general media presentations, for retrieving and analysing molecular biology as the main theme of the course is to understand molecular genetics as an experimental discipline.

Departmental 12
(BOTPCOR12T)
Plant Physiology & Biochemistry

After successful completion of theoretical and practical courses students will be able to understand –

1. General aspects of plant physiology and biochemistry.
2. The plant physiological mechanism – Photosynthesis, Photorespiration, Nitrogen fixation, plant specific growth hormonal control etc.
3. Basic physiological and Biochemical knowledge of plant system that will help them to build up their further concepts and will be knowledgeable enough to choose their elective courses in the next semester depending upon their understanding about the relevant subjects.

Departmental 13
DSE 1
(BOTPDSE01T)
Plant developmental biology and anatomy

After successful completion of theoretical and practical courses students will be able to –

1. Understand the state-of-the-art knowledge about plant developmental biology an anatomy, identified as up-coming research area.
2. Understand the plant developmental processes with identification of the gene associated with the developmental events are mostly carried out in model species, mainly based upon mutant generation.
3. Understand and admire the fascinating areas of research in these aspects.

Departmental 14
(BOTPCOR14P)
Laboratory course Molecular & Cellular Genetics & plant breeding

After successful completion of theoretical and practical courses students will have –

1. Hands-on-training to different experiments on molecular biology, cytogenetics and plant breeding and develop technical capability in the selection and use of appropriate laboratory and other materials and equipment.
2. Ability to employ acquired expertise in a safe and responsible manner to achieve the desired outcome.

Departmental 15
(BOTPCOR15P)
Laboratory course Plant Physiology & Biochemistry

After successful completion of theoretical and practical courses students will have –

1. Hands-on-training to different experiments on plant physiology, biochemistry and plant developmental studies.
2. Knowledge to carry out experiments on major plant biochemical events like – photosynthesis, compatible solute accumulation under stress condition, enzymatic activity estimation, K_m calculation etc.
3. Knowledge for pursuing further research.

Departmental 16
DSE 2
(BOTPDSE02T)
Advanced Plant Physiology & Biochemistry

After successful completion of the course the students will have -

1. An exposure to advanced areas of plant Physiology and biochemistry.
2. Enhanced and enriched knowledge to be helpful to pursue further research.

Departmental 17
DSE 3
(BOTPDSE03T)
Plant Molecular Biology

After successful completion of the course the students will have –

1. A comprehensive knowledge about major areas of plant biotechnology like – recombinant DNA technology, gene cloning, gene sequencing, genome projects, cloning vectors, proteomics, RNA interference, gene regulation, epigenetics etc.

Departmental 18P
(BOTPCOR18P)
Laboratory Course of DSE 2 & 3.

After successful completion of the course the students will have –

1. An working experience to prepare themselves for research.
2. Developed skills from identifying problems from the field, solving it in the laboratory, and taking it back to the field as solution.

Departmental 19P
(BOTPCOR19P)
Laboratory Course – Seminar Presentation

On completion of this course along with the departmental 20, the student skill sets will have substantially enhanced such that students will be able to take up a career in higher education and research. This course will particularly focus on presentation of the research findings/review done by the student in Departmental 20. As scientific communication is an essential and important component of scientific research, major emphasis has been given on this aspect.

Departmental 20P
(BOTPCOR20P)
Dissertation Project work

On completion of the course, the students –

1. Will be exposed to the research problems in the field through accessing web-based resources and physical databases (where applicable).
2. Will be able to design experiments and be aware of the various tools and technologies for it.

Will have an hands-on-training on different biological techniques, statistical procedures, in silico and wet lab instrumentation facilities.

ABILITY ENHANCEMENT COURSE

AECC
((BOTPAEC01M)
Understanding and presenting scientific literature

After successful completion of the course students will be –

1. Familiar with Journals in plant sciences, and related disciplines.
2. Able to Bibliographic and literature search using abstract (web of science etc.) and full text database platforms (Scopus, Science direct).
3. Able to bibliographic formatting using proprietary software like End Note, or other open-source ones.
4. Able to read review/research papers, understand and discuss them.
5. Able to improve presentation skill using ICT tools.

SKILL ENHANCEMENT COURSE
SEC 1
(BOTPSEC01T)
Biodiversity & Conservation

After successful completion of theoretical and practical courses students will be able to understand –

1. The concept and principles of biodiversity science, cause as well as current crisis and consequences of biodiversity loss.
2. Various means of conservation, restoration, and sustainable utilization of biodiversity, which can provide viable solution to a range of societal challenges and provides an effective tool to bridge the knowledge gap for sustainable management of biodiversity.
3. Linkage between biodiversity conservation, ecosystem services, climate change, and sustainable livelihood.

GENERAL ELECTIVE COURSE

GEC 1
(BOTPGEC01T)
Biosafety and Laboratory practices

After successful completion of theoretical and practical courses students will be able to –

1. Demonstrate the ability to work and use basic equipment safely and effectively in the laboratory.
2. Practice safe disposal and handling techniques following standard operational procedures.
3. Acquire knowledge about the biosafety and ecological safety requirements and regulations.

Program and Course Learning outcome of Undergraduate and Post Graduate course

Department of Chemistry

BIDHANNAGAR COLLEGE
SALT LAKE

INTRODUCTION

The B.Sc. Major in Chemistry at West Bengal State University, restructured under NEP 2020, offers a thoughtfully integrated curriculum spanning organic, inorganic, physical, and analytical chemistry, designed to develop critical thinking, analytical skills, and experimental proficiency. Emphasizing hands-on laboratory work, students engage with modern instrumentation, ICT tools, and statistical treatment of data to hone their observational and experimental design abilities. Through project-based research, the programme fosters self-directed learning and prepares learners for real-world applications. Contextual education—covering green chemistry, environmental impact, and safety—runs throughout the course, while elective modules broaden exposure to domains like polymers, novel energy sources, and medicinal chemistry. Clear program outcomes include robust foundational knowledge, quantitative problem-solving, data interpretation, and an understanding of materials and industrial chemicals. This interdisciplinary, research-oriented approach equips students with versatile skills for careers in academia, industry, environmental science, health care, and beyond.

The M.Sc. in Chemistry at Bidhannagar College, affiliated with West Bengal State University, is a rigorous two-year CBCS-based programme that seamlessly blends advanced theoretical instruction with extensive practical training, aiming to cultivate deep subject mastery and research competence. From the first semester, students build a robust foundation in core branches – organic, inorganic, physical, analytical, and materials chemistry – through in-depth lectures and sophisticated laboratory sessions. The curriculum incorporates state-of-the-art instrumentation — including UV-Visible spectrophotometers, rotary evaporators, analytical balances, computer-aided facilities, and modern labs — enabling hands-on learning and experimental precision. Emphasizing critical thinking and scientific inquiry, the programme features workshops, seminars, guest lectures, group projects, and case studies that foster collaborative learning and real-world problem solving. A hallmark of the course is its strong focus on research: students undertake independent projects under expert faculty guidance, supported by a dedicated research laboratory that regularly contributes to national and international publications. Moderate class sizes and active faculty–student interaction enhance the academic experience, with frequent invited lectures by eminent chemists and regular departmental events that further enrich learning. Flexible electives enable specialization tailored to individual interests, preparing graduates for diverse career pathways—ranging from academia, research, and pharmaceuticals to materials science, environmental science, and beyond. Overall, the M.Sc. Chemistry programme at Bidhannagar College is a comprehensive, research-oriented journey that equips students with the theoretical depth, experimental dexterity, and analytical skills essential to excel in modern chemical science.

Program and Course Learning outcome of Undergraduate course

Courses offered

Semester 1 Total Credit 27	Semester 2 Total Credit 27	Semester 3 Total Credit 24	Semester 4 Total Credit 20
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5 Total Credit 20	**Semester 6 Total Credit 20**	**Semester 7 Total Credit 20**	**Semester 8 Total Credit 20**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOMES	
PO1:	Students acquire knowledge about the concepts in Chemistry.
PO2:	Undertake hands on lab work and activities that help develop in students' practical knowledge and skills on of qualitative and quantitative analysis, required for pursuing career in different fields.
PO3:	Recognize and appreciate the importance of the chemical sciences and its application in academic, industrial, economic, environmental, and social contexts.

PROGRAM SPECIFIC OUTCOMES	
PSO1:	Develop comprehensive and advanced knowledge of the fundamental theories, principles, and mechanistic processes governing the core sub-disciplines of chemistry, including organic, inorganic, physical, and analytical chemistry.
PSO2:	Apply appropriate methodologies to conduct chemical syntheses, analyses or other chemical investigations.
PSO3:	Communicate complex chemical concepts effectively in oral and written forms and collaborate in diverse academic, laboratory, and industrial settings.
PSO4:	Use skills required for the extraction, separation, identification and synthesis of a variety of organic compounds utilized in chemical and pharma industry.
PSO5:	Develops skills related to different analytical methods and acquire knowledge about the use of IR, NMR and other spectroscopic techniques in the identification of inorganic and organic compounds.
PSO6:	Apply critical thinking to solve problems in core areas of chemistry through scientific inquiry and experimental analysis.
PSO7:	Use digital tools for chemical simulations, data analysis, and research, while pursuing continuous self-directed learning.
PSO8:	Apply chemical techniques and disciplinary knowledge across core and interdisciplinary areas-such as organic, inorganic, physical, analytical, medicinal, materials, and environmental chemistry-to solve chemical problems and empowered them to pursue advanced academic or industrial research.
PSO9:	Adhere to ethical practices, ensure data integrity, and demonstrate environmental and safety awareness in scientific work.
PSO10:	Integrate concepts from multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Chemistry.
PSO11:	Develop communicative skill and human values.

PO-CO MAPPING

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9	PSO-10	PSO-11
DS-1	✓	✓		✓				✓			
DS-2	✓	✓		✓				✓			
DS-3	✓	✓	✓	✓				✓			
DS-4	✓	✓	✓			✓		✓	✓		
DS-5	✓	✓		✓		✓		✓	✓		
DS-6	✓	✓				✓		✓			
DS-7	✓				✓		✓	✓			
DS-8	✓	✓				✓		✓			
DS-9	✓	✓				✓		✓			
DS-10	✓	✓				✓		✓			
DS-11	✓				✓		✓		✓		
DS-12	✓	✓				✓		✓			
DS-13	✓	✓		✓				✓			
DS-14	✓	✓				✓			✓		
DS-15	✓		✓					✓	✓		
DS-16	✓	✓				✓		✓	✓		
DS-17	✓	✓	✓			✓		✓	✓		
DS-18	✓	✓			✓	✓		✓	✓		
DS-19	✓	✓			✓			✓			
DS-20	✓	✓		✓				✓	✓		
DS-21	✓	✓				✓		✓	✓		
MA-1/MB-1										✓	
MA-2/MB-2										✓	
MA-3/MB-3										✓	
SM-1/SM-2										✓	
MD-1/MD-2/MD-3										✓	
AEC-1											✓
AEC-2											✓
AEC-3											✓
SEC-1	✓	✓			✓	✓		✓	✓		
SEC-2	✓					✓		✓	✓		
SEC-3										✓	
VAC-1											✓
VAC-2											✓

COURSE LEARNING OUTCOME

DEPARTMENT SPECIFIC COURSE (DSC)
DS-1
CEMDSC101T & CEMDSC101P
Fundamentals of Chemistry-1
[*Atomic Structure and chemical periodicity, Basics of Organic chemistry, Kinetic Theory and Gaseous state*]

Upon successful completion of this course, students will be able to-

1. Understand Atomic Structure from both classical and quantum mechanical Rules for naming acyclic organic compounds accurately.
2. Grasp Organic Chemistry Fundamentals, including molecular shapes, covalent bonding, Valence Bond Theory, Molecular Orbital Theory (qualitative understanding of σ, σ*, π, π*, n orbitals), and Hückel's rule for aromaticity.
3. Analyse Electronic Effects and Steric Factors like inductive, mesomeric, and hyperconjugation effects on the physical and chemical properties of organic molecules.
4. Understand Reaction Intermediates such as carbocations, carbanions, and free radicals, along with their formation and stability.
5. Explain the Kinetic Theory of Gases, including Maxwell's distribution of molecular speeds, and calculate average, root mean square, and most probable speeds, as well as concepts of mean free path, collision frequency, effusion, and viscosity.
6. Explore Real Gas Behaviour, including deviations from ideal gas laws, van der Waals equation, Boyle temperature, critical constants, virial equation of state, and the law of corresponding states.

After completion of the practical course students will acquire the skills to do the-

1. Preparation of primary and secondary standard solution and standardisation of secondary standard solution
2. Systematic identification of a pure, solid organic compound
3. Determination of molecular properties of liquids: relative viscosity with respect to water and relative surface tension with respect to water using Stalagmometer

DS-2
CEMDSC202T & CEMDSC202P
Fundamentals of Chemistry-2
[*Acid-Base Reactions, Stereochemistry, Chemical Kinetics*]

After completion of this course a student will understand-

1. Understand the physicochemical properties of solvents and apply various acid-base theories (Arrhenius, Brønsted-Lowry, and Lewis) to assess the relative strength of acids and bases, including equilibrium concepts such as buffer action and titration curves.
2. Apply concepts of solubility and solubility product to predict precipitation reactions and quantitatively analyse ionic equilibria in aqueous solutions.
3. Analyse the stereochemistry of organic molecules, including the use of different projection formulas (Fischer, Newman, Sawhorse), and understand molecular symmetry and chirality.
4. Identify and name stereoisomers using IUPAC nomenclature, and predict optical activity based on structural features of chiral molecules.

5. Perform conformational analysis of acyclic compounds, evaluating the influence of electronic and steric effects on molecular stability and reactivity.
6. Quantify the kinetics of chemical reactions by determining rate laws, rate constants, and reaction orders using integrated and differential methods, including the concepts of half-life and pseudo-first order reactions.
7. Apply theories of chemical kinetics such as Collision Theory, Transition State Theory, and catalysis mechanisms (acid-base and enzyme catalysis), with practical examples like the hydrolysis of esters and decomposition of hydrogen peroxide.

After completion of the practical the students will develop the ability to do the-

1. Acid-base titrations
2. Systematic analysis of single and pure liquid Studies of kinetics of simple chemical reactions: acid catalysed hydrolysis of ester and kinetics of decomposition of H_2O_2.

DS-3

CEMDSC303T & CEMDSC303P

Chemical Reaction: Properties and Energetics

[*Chemical periodicity and redox reactions, Substitution, Elimination Reactions and Reaction Kinetics, Chemical Thermodynamics I*]

After completion of this course a student will-

1. Understand periodic properties by analyzing electronic effects and group trends across s-, p-, and d-block elements, including the inert pair effect.
2. Interpret redox behavior through redox potentials and construct Latimer and Frost diagrams to explain oxidation-reduction processes of common elements.
3. Explain key organic reaction mechanisms, including aliphatic nucleophilic and electrophilic substitutions, and elimination reactions.
4. Analyze reaction energetics using concepts such as activation energy, energy profiles, kinetic isotope effect, catalysis, and tautomerism.
5. Apply thermodynamic principles to classify systems, explain the zeroth and first laws of thermodynamics, and distinguish between types of thermodynamic processes.
6. Perform thermodynamic calculations involving heat, work, internal energy, and enthalpy in reversible, irreversible, isothermal, adiabatic, and free expansion processes.
7. Evaluate energy changes and spontaneity using thermochemical laws (Hess's and Kirchhoff's) and the second law of thermodynamics, including entropy, Carnot cycle, and Carnot engine efficiency.

After completion of the practical the students will develop the ability to do the-

1. Estimation of concentration of Inorganic compounds in some selected salts.
2. Separation of binary mixture, purification of compounds and determination of boiling point of liquid compounds.
3. Physical experiments: Studies on heat of neutralisation, determination of heat of solution of benzoic acid in water.

DS-4

CEMDSC404T & CEMDSC404P

Inorganic Chemistry-I

[*Radioactivity and Chemical Bonding*]

Post completion of the course, the students will have vivid idea on the concepts of radioactivity and chemical bonding. The details are as follows-

1. Basic concepts of natural & artificial radioactivity and its useful applications in various fields like chemistry, biology, medicine, agriculture and geology including its safety measures.
2. Useful aspects of ionic including the idea of Born-Landé equation, Kapustinskii expression & Born-Haber cycle, and its application.
3. Weak chemical forces and their beautiful reflection in various chemical land biochemical systems.
4. Comprehensive understandings of covalent bonding including the knowledge of valence bond theory, Bent's rule, VSEPR theory and ground state Term symbols.
5. Details of Molecular Orbital theory including the metallic bond and its application on simple inorganic molecules/ions.

Students will also learn the experimental techniques for quantitative estimation of various inorganic ions or ion mixtures using titrimetric and gravimetric methods.

DS-5
CEMDSC405T & CEMDSC405P
Organic Chemistry-I
[*Stereochemistry, Alkanes, Alkenes, Alkynes, Aromatic Substitution Reactions & Phenol, Alcohols, Ethers, Carboxylic acids & Derivatives*]

After end of the course, students will be enriched on the following topic:

1. Chirality arising out of stereo-axis, concept of prostereoisomerism and related configurational descriptors, and methods of racemization.
2. Synthesis and chemical reactions of alkanes, alkenes and alkynes including the mechanistic pathways.
3. Electrophilic and nucleophilic substitution reactions in various aromatic systems.
4. Synthesis and useful chemical properties of monohydric and dihydric phenols.
5. Synthesis, physical properties (boiling point, polarity and solubility) and useful chemical reactions of alcohols and ethers.
6. Synthesis of carboxylic acids and acid derivatives; Comparison of reactivity of various acid derivatives, Mechanism of various methods (BAC2, AAC2, AAC1, AAL1) of ester hydrolysis.

By attending the practical classes, the students will be able to perform qualitative analysis of single solid organic compounds. They will also learn about some synthetic methods using green methodology.

DS-6
CEMDSC406T & CEMDSC406P
Physical Chemistry-I
[*Chemical Thermodynamics, Chemical & Ionic Equilibrium, Transport Phenomenon and Quantum Mechanics I*]

After completion of the theory course, the students will have in-depth knowledge on the following topics.

1. Thermodynamic relations such as auxiliary state functions, Maxwell's relations; Gibbs-Helmholtz equation, Joule-Thomson experiment and its consequences.
2. Chemical potential and partial properties
3. Chemical and ionic equilibrium; equilibrium constant (Kp, Kc, Kx) and effect of external parameters on the equilibrium constant.
4. Chemical potential of an ion in solution and Debye-Hückel limiting law& its applications.

5. Transport phenomena, viz. Fick's law, viscosity, conductance and transport numbers, application of conductance measurement.
6. Foundation of quantum mechanics, Schrodinger time-independent equation - Orthogonal and normal wavefunctions.

   After finishing the practical module of the course, the students will be able to carry out conductometric experiments on titrations, kinetics, verification of law, determination of solubility.

DS-7
CEMDSC407T
Molecular Spectroscopy
[*NMR, UV, IR, Rotational, Vibrational and Raman Spectroscopy*]

Completion of this course will ensure through understandings of the following spectroscopic techniques.

1. **NMR spectroscopy –** Basis and application of NMR spectroscopy in case of organic compounds, analysis of the spectrum.
2. **UV- spectroscopy** – Introduction to UV spectroscopy. Effect of structure and conditions upon the position & intensity of the spectrum.
3. **IR spectroscopy –**Origin of IR spectroscopy; characteristic and diagnostic stretching frequencies in organic compounds and inorganic complexes, application in functional group analysis.
4. **Rotational spectroscopy –**Principles of rotational spectroscopy, including rigid and non-rigid rotor models, spectral analysis, and applications in bond length determination and microwave oven operation.
5. **Vibrational & Raman Spectroscopy** - theoretical basis, features and analysis of the spectrum.

DS-8
CEMDSC508T & CEMDSC508P
Inorganic Chemistry 2
[*Chemistry of s, p and d Block Elements and coordination chemistry-I]*

After completion of this course a student will understand-

1. Distinct oxide, halide, and bonding characteristics of alkali and alkaline earth metal salts with group variations.
2. Various bonding types of boron and their related clustered compounds so that students can highlight how structure varies throughout the group.
3. The catenation features in group 14 elements variation and how Group 15 elements can generate different acids with varying oxidation states.
4. Chalcogen and its family are capable of producing a variety of significant acids and oxides that can distinguish themselves with the aid of structural effects.
5. Many acids in this category and their oxidation power.
6. Different chemical reactivity of various halogens and interhalogen compounds.
7. Properties and chemical reactivities of Nobel gases.
8. Preliminary concept of metal-metal bonding with structure and properties.
9. The coordination properties of the transition can also learn in this section.
10. IUPAC nomenclature of coordination complexes (up to two metal centres), Isomerism in coordination compounds, constitutional and stereo isomerism, Geometrical and optical isomerism in square planar and octahedral complexes can be known from this course.

In laboratory, Students learn complexometric titration in the Ca/Mg mixture, so they gather several water sources and use complexometric titration to compare the hardness.

DS-9
CEMDSC509T & CEMDSC509P
Organic Chemistry
[*Carbonyl and Related Compounds, Organometallics, Nitrogeneous compounds and Rearrangement Reactions]*

After completion of this course a student will learn-

1. Various reactivity of carbonyl functional groups and different name reactions related to carbonyl group.
2. Protection and deprotection of carbonyl groups and chemoselective oxidation and reduction of carbonyl group in the presence various reagent. Student can design pharmaceutical active heterocyclic and carbocyclic ring with help of name reactions.
3. To exploit acidity of α-H of carbonyl compounds and this related name reactions.
4. Nucleophilic addition to α,β-unsaturated carbonyl system
5. Preparation and reactivity of Grignard reagent, Gilman reagent and organolithium compounds
6. The nucleophilicity of different functional groups, such as carbonyl, ester, acid cynide, etc. by preparing various organometallic reagents based on magnesium, copper, or zinc.
7. Preparation and reactivity of amines, nitro and cyano compounds.
8. Preparation and reactivity and related name reactions of diazonium salts
9. Mechanism and stereochemical features for rearrangement to electron deficient carbon, nitrogen and oxygen.
10. Different name reactions related to migration from oxygen to ring carbon, from nitrogen to ring carbon.

In laboratory, Students learn-

1. Quantitative estimation of glycine, glucose, vitamin-C, and aniline, oil/fat/ester.
2. They the separation procedure of mixture containing: 2/3 amino acids and 2 dyes (fluorescein and methylene blue)

DS-10
CEMDSC510T & CEMDSC510P
Physical Chemistry 2
[*Surface Phenomenon, Electrical Properties, Quantum Chemistry 2 and Photochemistry]*

After completion of this course a student will learn-

1. Definition and illustration of surface tension and energy, spreading of liquid over surface and temperature dependence of surface tension.
2. Types of adsorption: physical, chemical and multilayered adsorption, BET and Gibbs adsorption isotherms.
3. Colloids: Classification and stability of colloids, mechanism of coagulation and electrokinetic phenomena.
4. Electrochemical cells: types and illustration, different kinds of half cells and application of EMF measurement

5. Concentration cells: types and illustration, liquid junction potential and potentiometric titration.
6. Definition and illustration of polarizability and dipole moment, Clausius-Mosotti equation and Debye equation and their application.
7. Concepts of different operators and postulates of quantum mechanics.
8. Explanation and application of particle in a box problem and extension to two and three dimensions.
9. Laws of photochemistry, Lambert-Beer's law: explanation, quantum yield.
10. Potential energy diagram, Frank-Condon principle, Jablonskii diagram and different photophysical processes. Photochemical equilibrium and photo-sensitized reaction

In laboratory, Students learn-

1. Verification of Beer's law for $KMnO_4$ and $K_2Cr_2O_7$
2. Potentiometric titration of Mohr's salt and $AgNO_3$

DS-11
CEMDSC511T
Analytical Techniques in Chemistry
[*Qualitative and Quantitative Aspects of Analysis, Flame Atomic Absorption & Emission Spectroscopy, Quantitative Analysis and Analytical Techniques*]

After completion of this course a student will learn-

1. Different qualitative and quantitative aspects of analysis like sampling, errors, accuracy, precision etc.
2. Basic principles, instrumentation and use of flame atomic absorption and emission spectroscopy.
3. Basic principles of quantitative analysis by UV-VIS spectrophotometry.
4. Quantitative analysis by electroanalytical method
5. Different analytical techniques like thermogravimetry, electrochemical method, polarography and cyclic voltammetry.

DS-12
CEMDSC612T and *CEMDSC612P*
Inorganic Chemistry-3
[*Coordination Chemistry-II & III, Bioinorganic Chemistry-I, Organometallic Chemistry-I*]

After end of the course students will have enriched knowledge in the field of coordination chemistry and along with few topics of bioinorganic chemistry and organometallic chemistry. The details are as follows-

1. Elementary concept of Crystal Field Theory including splitting pattern, crystal field stabilization energy (CFSE) and OSSE, Jahn-Teller distortion.
2. Structure of spinel, Metal- ligand bonding (MO concept) and their effects on the oxidation states of transitional metals.
3. Origin of Magnetism and Colour: Orbital & spin magnetic moments, spin only moments and their correlation with effective magnetic moments including orbital contribution; super exchange and anti-ferromagnetic interactions; d-d transitions; L-S coupling.
4. Orgel diagrams for $3d^1$ to $3d^9$ ions. Racah parameter. Selection rules for electronic spectral transitions; spectrochemical series of ligands; charge transfer spectra.
5. Basic chemical reactions in the biological systems and the role of metal ions especially the mechanism of Na^+/K^+-ion pump.

6. Dioxygen molecule in life. Dioxygen management proteins: Haemoglobin, Myoglobin, Hemocyanine and Hemerythrin.
7. Definition and classification of organometallic compounds based on bond type.
8. 18-electron and 16-electron rules and applications of 18-electron rule to metal carbonyls, nitrosyls, cyanides.
9. Structures and preparation of mono and binuclear carbonyls of 3d series including π-acceptor behavior and synergic effect of CO.

   By attending the practical classes, the students will be able to perform qualitative analysis of inorganic samples using dry tests, wet tests and special tests with HCl, HNO_3 and NaOH extracts.

DS-13

CEMDSC613T and CEMDSC613P

Organic Chemistry-3

[*Pericyclic Reactions, Polycyclic Aromatic Hydrocarbon and Fullerenes, Retro-Synthetic Strategy in Organic Synthesis and Chemistry of Cyclic Compounds*]

After end of the course, students will be enriched on the following topic:

1. Mechanism (FMO approach), stereochemistry, regioselectivity in case of various types of pericyclic reactions under thermal and photochemical conditions. Type of pericyclic reactions include (a) electrocyclic reactions involving 4π- and 6π-electrons (b) cycloaddition reactions ([4+2] & [2+2]) (c) sigmatropic reactions ([1,3]- shift, [1,5]-H shifts and [3,3]-shifts)
2. Synthetic methods for the preparation of polynuclear aromatic hydrocarbons (Naphthalene, Anthracene, Phenanthrene and their derivatives) by Haworth, Bardhan-Sengupta, Bogert-Cook with mechanism.
3. Aromaticity, stability and characteristic chemical reactions of the polynuclear aromatic hydrocarbons.
4. General structural features of C60 fullerene (Buckyball), aromatic-antiaromatic nature, elementary idea of properties and uses. Idea about the other fullerenes.
5. Concept of disconnections in organic molecule and idea of synthons and synthetic equivalent, natural reactivity and umpolung; latent polarity in bifunctional compounds, FGI and FGA.
6. Concept of C-C disconnections and synthesis: one-group and two-group (1,2- to 1,5-dioxygenated compounds), reconnection (1,6-dicarbonyl).
7. Preparation, properties and synthetic applications of active methylene compoundse.g. diethyl malonate, ethyl acetoacetate, acetylacetone etc.
8. Application of protection-deprotection chemistry towards the synthesis of organic molecules and strategy of ring synthesis.
9. Concept of I-strain; Structure and conformational analysis of cyclohexane and its derivatives.
10. Conformation & Reactivity in cyclohexane system based on steric & stereoelectronic requirements in case of elimination, nucleophilic substitutions,merged substitution-elimination; rearrangements; Oxidation, Esterification, Saponification etc.
11. Reactions of cyclohexanone*:* Reduction with metal hydrides, organometallic addition, and cyanohydrins formation.

In laboratory, the students will learn to synthesize various organic compounds utilizing different methodology, purify the product by crystallization and calculate the yield.

DS-14

CEMDSC614T and CEMDSC614P

Physical Chemistry-3

[*Chemical Thermodynamics-III, Quantum Chemistry-III, Statistical Thermodynamics and Solid State*]

After completion of the theory course, the students will have comprehensive knowledge on the following topics.

1. Classification and illustration of colligative properties, thermodynamic derivation of different properties, calculation of molar mass, abnormal colligative properties.
2. Features phases, thermodynamic derivation of phase rule, phase diagrams of different systems.
3. Properties of binary solutions, deviations from ideal behaviour.
4. Properties of angular momentum operators, rigid rotator model of diatomic molecule, spherical harmonics and their properties, characteristics of simple harmonic oscillators
5. Concept of configuration, thermodynamic probabilities, and ensembles. Derivation of Boltzmann distribution and its application,
6. Concept of partition function, thermodynamic properties in terms of partition function, third law of thermodynamics.
7. Laws of crystallography, lattices, unit cell, planes, Bragg's law, Crystal structure of NaCl and KCl, specific heats of solids.

In the practical classes, the students will learn to carry out the following-

1. Study of kinetics and determination of indicator constant spectrophotometrically
2. Determination of CMC conductometrically
3. Study of phenol-water phase diagram

DS-15

CEMDSC615T and CEMDSC615T

Application Oriented Chemistry

[*Green Chemistry, Green Synthesis, Chemistry in Daily Life and Environment Related Chemistry*]

Upon successful completion of the course, the students will acquire knowledge on the following topic:

1. Introduction to Green chemistry; Twelve principles of Green Chemistry with their explanations and examples and special emphasis on Prevention of Waste/ byproducts, Atom Economy, use of green solvents, use of alternative sources of energy, catalysis, avoidance of unnecessary derivatization, inherent safer design (ISD).
2. Green Synthesis of Adipic acid, Catechol, Disodium iminodiacetate (alternative to Strecker synthesis). Microwave and ultrasound assisted few representative reactions.
3. Green alternative surfactants for carbon dioxide used for precision cleaning & dry cleaning of garments, Rightfit pigment, green plastic (polylactic acid), Cradle to Cradle Carpeting.
4. Future Trends in Green Chemistry focussing on biomimetic, multifunctional reagents and combinatorial green chemistry.
5. Chemistry of various products used in Daily Life such as dairy products, Food additives, adulterants & contaminants, Artificial sweeteners and Flavouring Agents, cosmetics and drugs.
6. Air Pollution: Air pollutants, prevention and control, Green house gases, acid rain. Ozone hole. Photochemical smog and PAN. Catalytic converters for mobile sources.

7. Criteria and standards of water quality-safe drinking water. Measurement of water quality parameters- (Colour, turbidity, total solids, acidity, alkalinity, hardness, sulphate, flouride, phosphate, nitrite, nitrate, BOD and COD). Water purification for drinking and industrial purposes. Pollution aspects of detergents, pesticides and insecticides, heavy metal pollution. Treatment of industrial liquid wastes.

DS-16

CEMDSC716T and CEMDSC716P

Advanced Inorganic Chemistry 1

[*Bioinorganic Chemistry-II, Reaction Kinetics and Mechanisms, Organometallic Chemistry-II, Organometallic and f-Block Elements*]

After the end of the course students will be able to know about the following-

1. Role of electron transfer proteins in biological redox reactions.
2. Mechanism of carbonate bicarbonate buffering system and biological nitrogen fixation
3. Importance of Photosystem-I, Photosystem-II and Vaska's compound
4. Metal ion toxicity, chelation therapy and Pt and Au complexes as drugs
5. Reaction kinetics and mechanism of substitution reactions in square planar and octahedral complexes, *trans*- effect.
6. Preparation, properties and reaction of Ferrocene, Zeise's salt and other organometallic compounds.
7. Application of Wilkinson's Catalyst, Ziegler-Natta catalyst, Wacker Process, Synthetic gasoline
8. Electronic configuration, oxidation states, colour, spectral and magnetic properties of Lanthanoids and Actinoids.

In laboratory, Students will be able to identify acid and basic radicals in inorganic samples by performing dry, wet and special tests. Finally, they will learn how to get probable composition of the given samples.

DS-17

CEMDSC717T and CEMDSC717P

ADVANCED ORGANIC CHEMISTRY-1

[*Heterocyclic Compounds, Carbohydrates, Amino Acids, Peptides and Proteins, Bioorganic Chemistry*]

At the end of the unit students will get a detailed idea about: -

1. Different synthetic protocols, physical characteristics, and different chemical reactions of 5 and 6-membered heterocycles.
2. Structure and characteristic chemical reactions of monosaccharides and structures of disaccharides.
3. The different synthetic routes, physical and chemical properties of amino acids along.
4. Synthesis of peptides, determination of its amino acid sequence, structure of proteins.
5. Structure and stability of Nucleic acids and other important nucleotides.
6. Brief introduction of DNA-replication and RNA transcription, vaccine generation involving COVID-virus.

In Laboratory, student will learn

1. Qualitative analysis of single solid organic compounds.
2. Isolation of natural products; Caffeine, Piperine and Lycopine

DS-18
CEMDSC818T and CEMDSC818P
Advanced Physical Chemistry 1
[*Symmetry and Group Theory, Electrochemistry Quantum Chemistry IV Theoretical Spectroscopy*]

After end of the course students will be able to know about the following-

1. Symmetry elements and operations and Classification of molecules, Group, sub-group, point groups, point group symbols.
2. Representation, Great orthogonality theorem and its consequences, Character table, Symmetry adapted linear combination (SALC)
3. Debye Hückel theory and its extension
4. Debye Hückel Onsager theory and its extension.
5. Finite potential barrier problems, Variation Theorem
6. Qualitative treatment of hydrogen atom and hydrogen-like ions.
7. Nature of electromagnetic interaction, Induced and spontaneous radiative processes, Einstein coefficients.
8. Transition moment integral with application to selection rules, Fourier transformation; Stark effect, Breakdown of Born-Oppenheimer approximation.

In laboratory, student will come to know about:

1. Titration of acid determination of isoelectric point of an amino acid pH metrically
2. Verification of Onsager equation using KCl.
3. Determination of pH of unknown buffer and isosbestic point of BCG indicator spectrophotometrically.

DS-19
CEMDSC819T and CEMDSC819P
Advanced Inorganic Chemistry 2
[*General Principles of Silicate Industries Glass, Metallurgy, Batteries and Alloys Batteries, Fertilizers and Explosives Fertilizers*]

By the end of this course a student will come to know about:

1. General occurrence of metals, Ellingham diagrams for reduction of metal oxides
2. Electrolytic Reduction, Hydrometallurgy, and different Methods of purification of metals
3. Composition, Classification, and properties of different types of glasses.
4. Important clays and feldspar, ceramic, their types and manufacture, high technology ceramics and their applications.
5. Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process.
6. Types, Characteristics and components of battery and its working principles.
7. Classification and properties of alloys, composition and properties and manufacture of different types of steels.
8. Origin of explosive properties in organic compounds, preparation and properties of some selected explosives and introduction to rocket propellants.

In laboratory, a student will acquire knowledge about

1. Estimation oxygen in pyrolusite, chlorine in bleaching powder.
2. Estimation of Ca and Mg in Dolomite and Cr and Mn in steel

3. Measurement of 10Dq by spectrophotometric method.
4. Estimation of Ni^{2+} and Fe^{3+} in amixture by complexation with DMG spectrophotometrically.
5. Determination of λ_{max} of $[Mn(acac)_3]$ and $[Fe(acac)_3]$ complexes.

DS-20
CEMDSC820T and CEMDSC820P
Advanced Organic Chemistry 2
[*Asymmetric synthesis, Natural products, Bioorganic Chemistry*]

This course will enrich students with concepts on:
1. Asymmetric synthesis and different models on controlling chirality during chiral synthesis
2. Structural feature, general occurrence, isolation and characterisation, semi-synthetic and biosynthetic route and medicinal importance of some selected Terpenoids and Alkaloids.
3. Classification, characteristics and action of enzyme, fit and induced fit model. Regulation of action of enzymes and inhibition of action.
4. Common features and reactions of fats and oils.
5. Basic structural features of cholesterols and concept of LDL, HDL and VLDL.
6. Different oxidising and reducing agents and their uses in organic syntheses

In laboratory, student will learn multistep organic synthesis, monitoring of the progress of reaction and estimation of active compounds in few drugs.

DS-21
CEMDSC821T and CEMDSC821P
Advanced Physical Chemistry 2
[*Introduction to Polymer Chemistry, Kinetics and Application of Polymers, nonmaterial 1 and 2*]

After end of the course students will be able to know about the following-
1. Polymers: Classification, nomenclature and bonding
2. Determination of molecular weight by various methods.
3. Structure of polymer, morphology of crystalline polymers and polymerisation method
4. Mechanism and kinetics of polymerization and copolymerisation
5. Preparation, structure, properties and application of some selected polymers.
6. Introduction to Nanoscience: concept of confinement, concept of quantum well, quantum wire and quantum dot.
7. Types of nanomaterials: Synthesis and uses of nano clusters and nano composites, carbon nano tubes, metal nano crystals and semiconductor nanomaterials.
8. Properties of nanomaterials: Optical, Magnetic, Electronic and mechanical an syntheses.

In laboratory a student will acquire knowledge about:
1. Polymerization of Styrene and nylon 66.
2. Preparation of polystyrene, acrylamide urea-formaldehyde resin/novolac resin.
3. Determination of molecular weight by viscosity-average and by end group analysis:
4. Synthesis and study of silver nano particles.

SKILL ENHANCEMENT COURSE (SEC)
SE-1/SE-3
CEMHSE101M/CEMMSE301M
Basic Analytical Chemistry

This course will enrich the students with basic concepts on:

1. Analytical chemistry and its interdisciplinary nature, concept of sampling, accuracy, precision and error, presentation of data
2. Analysis of soil: composition, pH and complexometric titration
3. Analysis of water: pure and contaminated water, determination of pH and dissolved oxygen
4. Analysis of food: nutritional value, processing, preservation and adulteration, identification of adulterate, identification of adulterate and analysis of preservatives.
5. Principles of chromatography, paper chromatography, TLC, separation of mixtures of metal ions and ion exchange chromatography.
6. Analysis of major and minor constituents of deodorant, antiperspirant and talcum powder.
7. Estimation of macronutrients in soil by flame photometry.
8. Spectrophotometric determination of iron in vitamin and dietary tablets, caffine and benzoic acid in soft drinks.

SE-2
CEMHSE202M
Analytical and Clinical-Biochemistry

At the end of the course students will understand –

1. Biological importance of carbohydrates
2. Structure, classification, biological importance of proteins
3. Nomenclature, characteristics, classification and mechanism of action of enzymes, Biocatalysts
4. Structure, classification, biological importance of lipids
5. Properties, functions, and biochemical functions of lipoproteins
6. Structure and biological role of DNA, RNA, Genetic code, Gene therapy
7. Composition and function of blood, collection and preservation of blood samples
8. Collection and preservation of samples of urine, composition and estimation of constituents of urine.

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3
CEMHMD101M/ CEMHMD201M/ CEMHMD301M/

Upon successful completion of this course, students will be able to-

1. Basic concepts of chemistry, concepts, nature and different properties of solid, liquid and gas
2. Structure of atom using Rutherford and Bohr's model
3. Basic concepts of thermodynamic like system, surroundings, heat, work and internal energy.
4. Idea of chemical equilibrium, Le Chatelier's principle and its applications
5. Introduction and Preparation of haloalkane, alcohol, ether carbonyl and carboxylic acid
6. Arrhenius and Lewis concept of acid and bases, acid base titration

Post Graduate Program and Course Learning outcome

Courses offered

Semester 1	Semester 2	Semester 3	Semester 4
COR01, COR02, COR03, COR04, COR05, AEC01	COR06, COR07, COR08, COR09, COR10, SEC01	COR11, COR12, COR13, COR14, DSE01, GEC01	COR015, COR16, COR17, DSE02, DSE03

PROGRAMME OUTCOMES	
PO1:	Students acquire comprehensive and in-depth understanding of fundamental and applied concepts across all major branches of chemistry: Organic, Inorganic and Physical.
PO2:	Students develop critical thinking and problem-solving abilities through advanced experimental techniques, data analysis, and interpretation in a research-oriented framework.
PO3:	Students communicate scientific knowledge clearly and effectively through oral presentations and written reportsand develop an attitude for lifelong learning and engage in continuous professional development through higher education and competitive exams.

PROGRAM SPECIFIC OUTCOMES	
PSO1:	Understand and integrate advanced theoretical knowledge from organic, inorganic, physical, analytical, and biological chemistry to solve complex chemical problems.
PSO2:	Acquire practical skills and domain-specific knowledge
PSO3:	Gain proficiency in using contemporary tools and techniques, including spectroscopy, chromatography, computational chemistry and instrumentation used for chemical research.
PSO4:	Use computational tools for molecular modelling, quantum chemistry, and simulations to predict chemical properties and reaction mechanisms.
PSO5:	Apply logical reasoning and quantitative skills to analyze chemical data, evaluate reaction mechanisms, and interpret spectral and structural information.
PSO6:	Translate chemical understanding into innovations such as the development of new materials, drugs, catalysts, and sustainable chemical processes.
PSO7:	Be well-prepared for national-level competitive exams (e.g., CSIR-NET, GATE, SET) and international opportunities for higher education or research.
PSO8:	Formulate research problems, review literature critically, carry out independent research projects, and present findings in scientific forums or publications.
PSO9:	Collaborate effectively in diverse and multidisciplinary teams, demonstrating leadership, responsibility and initiative in professional settings
PSO10:	Exhibit professional ethics, safety consciousness, and responsibility towards society in chemical research, education, and application

PO-CO MAPPING

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9	PSO-10
COR-01	✓				✓		✓			
COR-02	✓		✓		✓		✓			
COR-03	✓			✓			✓			
COR-04			✓		✓				✓	✓
COR-05		✓	✓						✓	✓
COR-06	✓					✓	✓			
COR-07	✓					✓	✓			
COR-08	✓			✓			✓			
COR-09		✓	✓		✓				✓	✓
COR-10		✓	✓		✓				✓	✓
COR-11	✓		✓				✓			
COR-12	✓		✓				✓			
COR-13	✓			✓	✓		✓			
COR-14		✓		✓	✓				✓	✓
COR-15	✓		✓				✓			
COR-16	✓					✓	✓			
COR-17	✓		✓	✓						
DSE-01	✓	✓	✓	✓	✓		✓			
DSE-02	✓		✓	✓			✓			
DSE-03		✓		✓	✓			✓	✓	✓
AEC-01		✓	✓	✓						
SEC-01			✓		✓		✓			
GEC-01	✓		✓		✓		✓			

COURSE LEARNING OUTCOME

CORE Courses

COR-1
CHEMCOR01
Inorganic Chemistry-1
[*Symmetry and point group, Coordination chemistry, Solid state chemistry and Electrochemical analysis*]

After completion of this course a student will understand-

1. Definition of Symmetry elements, operations and identification of point groups.
2. Matrix representation of symmetry operations and Reducible and irreducible representations
3. Statement and explanation of the important rules of "Great Orthogonality Theorem"
4. Basic principles of Crystal Field Theory and its applications
5. Construction of Orgel diagrams and selection rules for spectral transitions,
6. Learning about *d-d* spectra of d^n ions and CT transitions
7. Construction of MO diagrams of polyatomic molecules including coordination complexes (O_h and T_d), sandwich complexes: (ferrocene, dibenzenechromium).
8. Magnetic properties of coordination compounds
9. Schottky and Frenkel defects.
10. Stoichiometric imbalance in crystals and non-stoichiometric planes, colors centers in ionic crystals.
11. Band theory, semiconductor, rectifiers and transistors.
12. Basic principle, instrumentation and applications in inorganic analysis of the following techniques
13. Electroanalytical methods: Polarography: Ampherometric titration, Coulometry, cyclic voltametry, ion selective electrode, electrogravimetry.

COR-2
CHEMCOR02
Organic Chemistry–1
[*Stereochemistry, Reaction mechanism and Methods of determination, Pericyclic reactions and NMR spectroscopy*]

Upon successful completion of the course, the students will acquire knowledge on the following topic:

1. Symmetry elements & point groups and types of stereoisomerism in organic molecules, axial chirality, planar chirality & helicity, stereochemical nomenclature.
2. Conformational features of cyclic systems, Correlation of molecular conformation with reactivity in substitution, elimination, addition, and rearrangement reactions using the Curtin-Hammett principle & Winstein-Holness equation.
3. Reaction mechanism and methods of determination focusing Isotope labeling, identifying intermediates, catalysis, kinetic methods, isotope effects, stereochemical course of the reaction.
4. Correlation of structure and reactivity using the Hammett equation and Hammett plot.
5. Woodward-Hoffmann selection rules & Explanation of pericyclic reactions using FMO approach, concept of Hückel / Möbius systems.
6. Features of various pericyclic reactions such as electrocyclic reactions, cycloaddition reactions, cheletropic reactions and sigmatropic rearrangements.
7. Basic theory and application of ^1H and ^{13}C NMR spectroscopy.

COR-3
CHEMCOR03
Physical Chemistry-1
[*Quantum Mechanics -1, Electrochemistry 1, Chemical Kinetics 1 and Spectroscopy*]

After completion of this course a student will understand-

1. Postulates of quantum mechanics and their analysis, Free particle: Barrier problem and tunneling phenomena, Equation of motion: Ehrenfest's theorem.
2. Angular momentum operators, hydrogen atom problem, spherical harmonics
3. Ion-ion interaction: Debye Huckel theory
4. Electrode kinetics: Butler-Volmer equation and its application, Corrosion and its control
5. Theory of rate processes: Collision theory and activated complex theory.
6. Factors affecting reactions between ions, Concept of volume of activation
7. Unimolecular reactions: Lindemann- Hinshelwood and RRK mechanism, Chain reactions, oscillatory reactions and autocatalytic reactions.
8. Nature of electromagnetic radiation: Shapes and width of spectral lines, intensity of lines, Fourier transform
9. Microwave spectroscopy: Moment of inertia and classification of molecules, symmetric rotor, Stark effect and dipole moment, Non-rigid rotor, Vibrational-rotational spectra.

COR-4
CHEMCOR04
Practical-1
[*Inorganic chemistry practical and Physical chemistry practical-1*]

After completion of the practical course students will acquire the skills to do the-

1. Students will be able to perform Synthesis, complexometric and spectrophometric estimation.
2. Determination of thermodynamic solubility product
3. Determination of standard electrode potential
4. Determination of hydrolysis constant of a salt and acidic and basic dissociation constant of amino acid pH metrically
5. Conductometric titration of halide mixture and determination of CMC of SDS

COR-5
CHEMCOR05
Practical–2
[*Organic Chemistry Practical*]

After completion of the practical course students will acquire the skills to do the-

1. Systematic qualitative analysis of a liquid organic compound.
2. Purification and drying of organic solvents.
3. Extraction and purification of organic compound from natural source.

COR-6
CHEMCOR06
Inorganic Chemistry-2
[*Chemical bonding, Chemistry of s, p &d block elements and Organometallic Chemistry I*]

After completion of this course a student will understand-

1. Construction and application of MO to homo- and hetero- nuclear diatomic and triatomic molecules/ ions
2. Learning about Huckel – pi – electron theory and its applications to ethylene, butadiene and benzene.
3. Learning about Lipscomb's topological concept and Wade's rules.
4. Discussion about macrocyclic ligands such as crown ethers, cryptates and spherand.
5. Classification, synthesis, reaction, structure and bonding, and application of typical examples of Organometallic compounds.
6. Learning about Periodic trends in respect of 3d, 4d and 5d elements with references to Ti-Zr-Hf, Cr-Mo-W, Mn-Tc-Re and Pt group metals.
7. Oxo compounds of Ru and Os and Rh(I) and Ir(I) compounds
8. Synthesis, properties, reactions, structure and bonding as applicable in respect of: Mo-blue, W-blue, Pt-blue, W-bronze, Ru-red, Creutz- Traube complexes, Vaska`s complexes.
9. Iso- and hetero metallates derived from V, Mo and W (synthesis, structure and applications).
10. Application of 18- electron and 16- electron rules to transition metal organometallics, structure, bonding and reactions.

COR-7
CHEMCOR07
Organic Chemistry–2
[*Synthetic Methodology, Heterocyclic Chemistry, Synthetic Strategy and Natural Products*]

Upon successful completion of the course, the students will acquire knowledge on the following topic:

1. Application of organoboron, organosulfur and organosilicon reagents in organic synthesis.
2. Hantzsch-Widman system for systematic nomenclature of heterocycles.
3. Use of heterocycles in organic synthesis, including masked functionalities and umpolung strategies.
4. General approaches to heterocycle synthesis, including cyclization and cycloaddition methods.
5. Synthetic strategies for natural products and tailor-made molecules using target-oriented approaches.
6. Appropriate reagents, catalysts, and strategic methodologies in method-oriented synthesis.
7. Structure elucidation, reactions and synthesis of representative examples of alkaloids, terpenoids and steroids.

COR-8
CHEMCOR08
Physical Chemistry-2
[*Mathematics for Chemistry and Quantum Mechanics II , Chemical Kinetics –II, Statistical Thermodynamics I and Group Theory*]

After completion of this course a student will understand-

1. Elements of calculus: Extremum principle, Power series, Vectors: Matrices and its application.
2. Particle on a ring: Rigid rotor, Harmonic oscillator.

3. Variation theorem and variational methods. Illustrative examples.
4. Enzyme catalysed reactions: Influence of pH, temperature and inhibitors on such reaction.
5. Surface reactions, kinetics of fast reaction, diffusion controlled reaction and its kinetics.
6. Entropy and probability, ensembles, partition function and thermodynamic properties.
7. Maxwell Boltzmann distribution, factorization of molecular partition function, calculation of thermodynamic properties and equilibrium constant of ideal gases in terms of partition function.
8. Group theory: Matrix representations, great orthogonality theorem and its consequences, character Table.
9. Symmetry adapted linear combination (SALC) with illustrative examples, construction of Molecular Orbitals using Huckel approximation

COR-9
CHEMCOR09
Practical-3
[*Inorganic chemistry practical*]

After completion of the practical course students will acquire the skills to perform-

1. Analyze known/unknown inorganic mixtures containing six radicals including two radicals derived from the rare elements (at least 4-5 samples)
2. Analyze of ores, minerals and alloys.

COR-10
CHEMCOR10
Practical–4
(*Organic Chemistry Practical, Physical chemistry Practical II and Lab Quiz*)

After completion of the practical the students will develop the ability to do the-

1. Separation, purification and identification of organic compounds in binary mixtures usingby chemical& spectroscopic (UV, IR, NMR) techniques.
2. Potentiometric titration of mixture of KI and KBr.
3. Kinetic study of autocatalytic reaction between $KMnO_4$ and Oxalic acid.
4. Verification of Onsager equation and determination of solubility product of sparingly soluble salt.
5. pH metric titration of polybasic acid and determination of dissociation constants.

Through Lab Quiz the students will acquire-

1. The general concept of principles of experiments for each branch of chemistry.

COR-11
CHEMCOR11
Inorganic Chemistry-3
[*Bio-inorganic Chemistry I Nuclear Chemistry & Radiochemical analysis, Chemistry of f-block elements and Complex equilibria*]

After completion of this course a student will understand-

1. Essential and trace elements in the biological systems.
2. Active site structures and biofunctions of hemocyanin and hemerythrin.

3. Biological redox couples and Biological nitrogen fixation; Photosystem (*PS*)-I, Photosystem (*PS*)-II and their roles.
4. Toxic effects of metal ions, metal dependent diseases, chelation therapy.
5. Study about Nuclear models and definition of Magic numbers, nuclear spin and nuclear isomerism; Nuclear fission and nuclear fusion; Study of kinetic isotope effect.
6. Radiometric analysis and their applications and Radiation hazards & safety measures
7. Nuclear stability, relativistic effect, electronic configuration, oxidation states, aqueous-, redox- and complex- chemistry; electronic spectra and magnetic properties.
8. Lanthanide and actinides – Properties and applications.
9. Understanding of Stepwise and overall formation constants and their relations.
10. Statistical and non-statistical factors, Spectrophotometric & pH metric determination of binary formation constants

COR-12
CHEMCOR12
Organic Chemistry–3
[*Photochemistry and radical reactions, Organotransition metal chemistry, Oxidation reduction and some special reactions*]

After completion of the theory course, the students will have comprehensive knowledge on the following topics-

1. Basic concepts of photochemistry and detailed study of various organic photochemical reactions such as the Paternò–Büchi reaction, Norrish Type I and II reactions, photo-reduction of ketones, and the di-π-methane rearrangement.
2. Bonding, geometries & stability of radicals, radical generation methods and key features of various radical addition & fragmentation reactions including C–X/C–C bond-forming and C-C bond-cleaving reactions
3. Basic idea of organometallic reaction mechanisms and synthetic applications of transition metal alkene, alkyne, and carbon σ-bond complexes, including Heck, carbonylation, and related reactions.
4. Application of transition metal carbene complexes (Fischer, Schrock) in metathesis and Tebbe's reagent-based transformations. Ziegler–Natta catalysis and its broad application.
5. Different traditional and modern oxidising/reducing agents and their application upon organic molecules.
6. Mechanisms and synthetic applications of some special reactions including Shapiro, Mitsunobu, Hofmann-Löffler-Freytag, Barton reactions, tandem cycloadditions, Baylis–Hillman, Passerini, and Ugi reactions.
7. Synthesis and reactions of various heterocyclic compounds such as aziridines, azitidines, oxazoles, thiazoles, imidazoles, isoxazoles, isothiazoles, pyrazoles, pyrimidines, pyridazines, pyrazines, purines, pteridines, azipines, oxepins, thiepins etc.
8. Role of heterocyclic compounds in biological systems, nomenclature of bicyclic and tricyclic fused systems,

COR-13
CHEMCOR13
PHYSICAL CHEMISTRY-3
[*Quantum Mechanics III, Nanomaterials, Statistical Mechanics II and Electrochemistry II*]

After completion of this course a student will understand-

1. Rayleigh-Schrodinger perturbation theory, time-dependent perturbation theory: derivation of Fermi's golden rule
2. Harmonic perturbation and transition probabilities.
3. Nanomaterials: Definition, classification and properties, synthetic methodologies
4. Nanostructures: Various kinds, Quantum dot, Carbon Nanotubes, Fullerene, Graphene etc, Nanotechnology: Biomedical application -drug delivery
5. Phase Space: Ergodic Hypothesis, Liouville's theorem, Ensembles: Application to selective systems
6. Fluctuations, Perfect gas and Sackur-Tetrode equation, Systems of interacting molecules: Black body radiation
7. Ion transport in solution: Debye-Huckel- Onsager theory and its extension.
8. Electrode surface: Potential and its measurement, Thermodynamics of electrified interface: Determination of excess charge and surface excess
9. Structure of double layer: Helmholtz Perrin model, Gouy Chapman model, Stern model and contact adsorption model.

COR-14
CHEMCOR14
PRACTICAL-5
[*Physical Chemistry Practical*]

After completion of the practical course students will acquire the skills to perform and understand -

1. Studies on primary kinetic salt effect, kinetics of iodination of acetone and ternary phase diagram.
2. Determination of thermodynamic functions on temperature controlled kinetic studies.
3. Determination of isoelectric point of a protein by Ostwald viscometer.
4. Determination of equilibrium constant of an ester hydrolysis and composition of a complex.
5. Potentiometric experiments on titration of weak acid and determination of standard electrode potential (Ag/Ag^+ system).
6. Conductometric titration of mixture of sulphates.

COR-15
CHEMCOR15
Inorganic Chemistry-4
[*Magnetochemistry, Inorganic ring, cages and clusters, Organometallic chemistry II and Chemical application of group theory*]

After completion of this course a student will understand-

1. Magnetic materials, magnrtic susceptibility and its determination, diamagnetism, spin-orbit coupling, Curie equation, Curies law and Curie-Weiss law
2. Zeeman effects, temperature independent paramagnetism and derivation and application of Van Vleck susceptibility equation, quenching of magnetic moments and spin crosser phenomenon
3. Magnetic behaviour of Lanthanides and actinides; magnetic exchange interactions, magnetic materials.

4. Metal-metal bonding (M.O. Approach), nuclearity carbonyl clusters, applications of isolobal and isoelectronic relationships, cluster compounds in catalysis
5. Industrial applications of catalytic by organometallic compounds, Tolman catalytic loop.
6. Photo dehydrogenation catalyst (platinum POP).
7. Construction and representation of character tables (C_2v, C_3v, C_4v, D_4)
8. Irreducible Representations, wave functions, symmetry of normal modes, normal mode analysis,
9. Selection rules for IR and Raman transitions.
10. Projection operator (without derivation), use of the projection operator to form symmetry adapted linear combination (SALC) of simple system.

COR-16
CHEMCOR16
Organic Chemistry–4
[*Asymmetric synthesis, Medicinal chemistry, Supramolecular chemistry, and Natural products (Biosynthesis)*]

Post completion of the course, the students will have thorough understandings of the following topics-

1. Stereoselective strategies to carbonyl and alkene reactions, including enolate alkylation, aldol reactions, Diels-Alder, rearrangements, and selective functionalization.
2. Idea of kinetic resolution in asymmetric synthesis and syntheses of menthol (Takasago) and Crixivan (Merck).
3. Structure and function of bacterial and animal cells and the mechanism of antibacterial agents, with emphasis on β-lactam antibiotics.
4. Synthesis and mechanisms of action of selected therapeutic agents including fluoroquinolones, anti-AIDS drugs, antihypertensives, calcium channel blockers, gastric secretion inhibitors, and drugs for erectile dysfunction.
5. Structure and biological role of vitamins (B-complex, C, K) and prostaglandins, along with their synthesis.
6. Principles of supramolecular chemistry, and structure & function of molecular receptors such as crown ethers, siderophores, cyclophanes, and cyclodextrins in selective binding processes.
7. Liquid crystals and supramolecular polymers. Design & function of supramolecular devices, sensors, and systems exhibiting self-assembly, self-replication and autocatalysis.
8. Biosynthesis of alkaloids, flavonoids, terpenoids and steroids.

COR-17
CHEMCOR17
PHYSICAL CHEMISTRY-4
[*Quantum Mechanics and Spectroscopy, Material Chemistry, Leaser and advance Photo-physics and Bio-physical chemistry*]

After completion of this course a student will understand-

1. Theoretical basis of interaction of radiation with matter: Harmonic perturbation and transition probabilities, Selection rule for vibrational and rotational spectra
2. Application of Group theory to molecular vibration, IR and Raman Spectra and their selection rules.
3. Free electron theory and its application in conductance and magnetism, Hall effect

4. Band theory and its application, theoretical basis of conductor, semiconductor and insulator, super conductor
5. Principles of Laser and Maser action, population inversion, characteristics of Laser radiation, harmonic generation and its application
6. Excited state intra and inter molecular proton transfer reactions, Excimer and Exciplex formation, Excited state electron transfer processes: Marcus theory,
7. Forster resonance energy transfer (FRET) and its applications
8. Biological macromolecules and membrane structure, Spectroscopic methods of identification: UV-Vis. and CD
9. Gel electrophoresis, macromolecule-ligand binding and co-operatively, Drug-DNA interaction

DEPARTMENT SPECIFIC ELECTIVES (DSE)

DSE-1
CHEMDSE01
SPECTROSCOPY

[*Mass & IR spectroscopy, Emission spectroscopy, Mossbauer spectroscopy & Photoelectron spectroscopy and Electron spin resonance spectroscopy*]

After completion of this course a student will understand-

1. Basic instrumentation, ion production - EI,CI, FD and FAB techniques, Mass spectral fragmentation of typical organic compounds
2. Characteristic vibrational frequencies of different functional groups of organic compounds.
3. Effects of solvent, hydrogen bonding on vibrational frequencies, overtones, combination bands and Fermi resonance, FT IR.
4. Franck-Condon principle, radiative and radiationless deactivation, Oscillator strength, Photophysical processes of unimolecular processes, Fluorescence quenchers, Delayed fluorescence
5. Kinetics of bimolecular processes: collision quenching, Stern-Volmer equation, Excimer formation, Excited state electron transfer processes
6. Principle of Mossbauer spectroscopy, Quadrupole interaction, magnetic interaction, Information of spin and oxidation states
7. Photo excitation and photoionization, Detection of atoms in molecules, Chemical shift,
8. Principle of EPR and spin Hamiltonian, Nuclear hyperfine interactions, Lande g factor, Coupling constants.
9. Zero field splitting, and Kramer`s degeneracy.
10. Basic instrumentation, measurement techniques and simple applications regarding structural information of organic radicals and inorganic molecules from EPR spectra.

DSE-2
CHEMDSE02
Inorganic Chemistry

[*Advanced bio-inorganic Chemistry, Spectroscopic analysis of inorganic compounds, Inorganic reaction mechanism and Crystallography*]

After completion of this course a student will understand-

1. Metal ions in genetic information transfer and in metabolic energy transfer
2. Bioinorganic chemistry of human iron metabolism, Hydrolytic metalloenzymes and Redox metalloenzymes ,Vitamins and coenzymes

3. Application of IR, UV, NMR, ESR, Mossbauer spectroscopy in different fields of inorganic chemistry
4. Kinetics of solid state reactions by TGA, DTA and DSC methods
5. Mechanism of electron transfer reactions, Frank-Condon principle
6. Outer sphere and Inner sphere reactions, applications of Marcus expression and redox catalyzed substitution reactions
7. Mechanism of substitution reactions and isomerisation reaction, Ray-Dutt and Bailartwist mechanisms.
8. Fundamentals of X-ray crystallography, crystal forms, lattice, crystal systems and classes, symmetry, space groups, crystals and their properties,
9. Diffraction of x-ray, lattice planes, indices, Bragg's condition, reciprocal lattice, structure factor, systematic absence, heavy atom method. Fourier synthesis, Patterson function,
10. Experimental diffraction methods (Laue method, rotating crystal method).

DSE-2
CHEMDSE02
Organic Chemistry
[*Advanced Stereochemistry, Advanced Pericyclic reactions, Advanced NMR Spectroscopy and Molecules of Life*]

Upon successful completion of this module, students will be enriched on the following advanced area of organic chemistry-

1. Conformational preferences and reactivity of monocyclic, bicyclic (6-4, 5-5), and tricyclic (6-6-6, 6-5-6, 5-6-6, 5-5-5) ring systems.
2. Principles of Circular Dichroism (CD) and Optical Rotatory Dispersion (ORD) and their applications.
3. General perturbation molecular orbital (PMO) theory to understand reactivity, regioselectivity, and periselectivity in cycloaddition reactions.
4. Correlation diagrams and mechanisms of 1,3-dipolar, higher-order & multi-component cycloadditions, ene reactions, group transfer reactions, electrocyclic reactions of charged systems and various sigmatropic rearrangements.
5. Advanced NMR techniques (DEPT, COSY, HMBC, HMQC, TOCSY, NOESY) for structure elucidation, drug screening, and reaction monitoring.
6. Characterization of organic compounds utilizing IR, UV, ^{1}H-NMR, ^{13}C-NMR, and mass spectrometry data.
7. **S**tructure and function of proteins, nucleic acids and carbohydrates (di- and polysaccharides). DNA replication, transcription, and protein biosynthesis
8. Chemical and biological synthesis of nucleosides, nucleotides, oligonucleotides, , and folic acid.

DSE-2
CHEMDSE02
PHYSICAL CHEMISTRY
[***Advanced quantum mechanics, Non-equilibrium thermodynamics, Macromolecules and Statistical Mechanics III***]

After completion of this course a student will understand-

1. Many-electron systems, antisymmetric principle, Self-consistent fields: Hartree and Hartree-Fock (HF) theories, Rootham equation and Koopmans' theorem.

2. Problems with open shell systems, Multidimentional wave function and configuration interaction, Brillouin's theorem.
3. Application of ab initio methods, Density functional theory, Virial theorem and chemical bonding, Hellmann-Feynman theorem
4. Meaning and scope of irreversible thermodynamics, Criteria for non-equilibrium states, Entropy production: specific examples, Phenomenological equations.
5. Microscopic reversibility and Onsager reciprocity relations: Examples and Illustration.
6. Non-equilibrium stationary states: Prigogine's principle of entropy production.
7. Polymers: Definition, Types of polymers, Polymerization processes, Kinetics of polymerization, Determination of molecular masses of polymers, Biomacromolecules (Proteins and DNA)
8. Formulation of quantum statistical mechanics, Density matrix, quantum Liouville theorem and its consequences, Quantum statistics and ensembles.
9. The specific heat of electron gas, Debye theory, Bose-Einstein condensation.

DSE-3
CHEMDSE03
LABORATORY EXPERIMENT AND RESEARCH PROJECT

Upon completion of this course, students will develop the ability to conduct advanced experiments and receive training in research methodologies. They will be able to select a specialization and effectively carry out experiments within their chosen field across the following three areas-

- **Physico-chemical experiments**
    1. Determination of composition of complexes formed in solution by spectrophotometric methods for model systems.
    2. Determination of stability constants of metal-ligand complexes by pH-metric methods.
    3. Kinetic study on consecutive reactions on some specific Model system.
    4. Kinetics studies on redox and substitution reactions on model system.

- **Multistep organic synthesis**

  Synthesis of model organic compounds involving typical multi step reactions, isolation and purification of the intermediate and the final products (as applicable) and their characterization by recrystallization, chromatographic separation (as applicable), determination of m.p / b.p (as applicable), and spectral measurements.

- **Spectrophotometric Experiments**
    1. Determination of molecular weight of a polymer by viscometric method
    2. Determination of complex composition by Job's method
    3. Determination of isosbestic point of BCG indicator
    4. Spectrophotometric kinetic study of alkaline hydrolysis of Crystal Violet and iodination of aniline

Project work and Literature Review: During Semester-IV, each candidate carries out some investigative work in four-week duration under the supervision of one or more guides(s), who is Teacher / Guest Teacher / Member of P.G Board of Studies of the College / University / Scientist of any Recognized Research Institute and they can-

1. Develop the ability to independently plan and execute a short-term research project, demonstrating initiative and critical thinking in a scientific investigation.
2. Gain practical research experience by working under the supervision of academic or research professionals in a recognized academic or research institution.
3. Acquire skills in scientific documentation and communication by preparing a dissertation based on research findings, and defending the work before an external evaluator.

SKILL ENHANCEMENT COURSE

SEC-1

CHEMSEC01
Chemical and Spectral Analysis

After completion of this course a student will understand-

1. Elucidation of different methods of synthesis and characterization of some representative coordination compounds
2. Procedure of analysis of various parameters of water like BOD, COD, DO, TOC, TOD etc.
3. Systematic application of the different spectral data to determine and confirm the structure of the molecule.

ABILITY ENHANCEMENT (COMPULSORY COURSE)

AECC-1
CHEMAEC01
Computer Operations for Chemical Science

After completion of this course a student will understand-

1. This course is computer-based. Students are familiar with chemistry-based software, including MNOVA and ChemDraw.
2. A crucial software tool for thoroughly understanding chemical properties is chemdraw, which may assist in drawing the chemical structure and artistically representing any chemical process.
3. MNOVA software is utilized for data analysis. NMR spectroscopy can be used to characterize the desired product during a chemical reaction. This software can analyze these data and solve the prediction of an unknown structure.
4. ORIGIN software and MS Excel are used for plot for UV VIS and Fluorescence data: Calculation of limit of detection in nanomolar level, binding constant from Benesi -Hindebrand plot, absorbance and fluorescence titration graph.

GENERIC ELECTIVE COURSE

GEC-1
CHEMGEC01
Basic thermodynamics, Spectroscopy and Essence of Biochemistry

After completion of this course a student will understand-

1. Basic idea of thermodynamics, Laws of thermodynamics, Thermodynamic properties of gases and solutions.
2. Basic concept and application of NMR spectroscopy, UV-Vis spectroscopy

3. Application of IR spectroscopy in the field of identification of organic functional groups
4. Basic instrumentation of mass spectroscopy and its application upon organic molecules.
5. Structure of proteins, Mechanism of selected enzyme action.
6. Roles of metal ions in various biological processes.

For UG NEP2020 syllabus of Chemistry in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2024/12/ChemistryNEP_Syllabus_2024.pdf

Program and Course Learning outcome of Undergraduate course

Department of Economics

BIDHANNAGAR COLLEGE

SALTLAKE

INTRODUCTION

The B.Sc. course in Economics at West Bengal State University, structured under the NEP 2020 syllabus, offers a rigorous and contemporary curriculum designed to equip students with a strong foundation in economic theory, quantitative methods, and applied analytical skills. The program covers key areas such as **microeconomics, macroeconomics, mathematical methods, statistics, development economics, and the Indian economy**, integrating both theoretical frameworks and real-world applications across its four-year structure. Students engage with core concepts in the first semesters and progress to advanced topics and electives, including mathematical optimization, statistical analysis, and sectoral studies, fostering a comprehensive understanding of economic phenomena. The course outcomes emphasize the development of critical thinking, problem-solving abilities, and quantitative proficiency, enabling graduates to analyze economic issues, interpret data, and formulate informed policy recommendations. Upon completion, students are well-prepared for diverse career paths in academia, research, government, business, and policy analysis, as well as for advanced studies in economics and related fields, reflecting the program’s commitment to producing graduates with both academic competence and practical skills suited to evolving economic challenges.

Program and Course Learning outcome of Undergraduate course

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOMES	
PO1	Theoretical Knowledge: Provide a comprehensive overview of economic theories, ranging from Classical to Modern, emphasizing their application and practicality
PO2	Statistical and Mathematical Skills: Ability to use mathematical tools to understand the dynamics of economic decision-making processes and solve real economic problems
PO3	Provide exposure to econometric tools and data analytics software that enable enhanced scope for employability of students.

Programme Specific Outcomes	
PSO1	**Disciplinary Knowledge** Apply the scientific knowledge acquired in classrooms and computer labs in real life situations and work environment.
PSO2	**Critical Thinking** Students will be able to understand the dynamics of economic policy formulation and implementation to address the real-world socioeconomic challenges.
PSO3	**Entrepreneurship and Employability Skills** Numerical, analytical and statistical proficiency will empower the students to become skilled professionals who will emerge as entrepreneurs or be employed in various positions in industry, academia, and Government
PSO4	**Policy Making Skills** Students will learn to formulate effective growth policies by using their theoretical, analytical and inference knowledge. They will apply different economic decision-making processes to predict human behavior in the real world and conclude whether their action was rational or irrational.
PSO5	**Forecasting Capabilities** By integrating theoretical knowledge with quantitative and qualitative evidences, the students will be able to explain the past economic events and forecast the future occurrences.
PSO6	**Digital Knowledge** The students will become adept at using various digital resources and obtain the capability to use and apply digital knowledge systems in their work environment.
PSO7	**Competency Development** Adapt in the workplace by possessing the capacity to embrace new opportunities of emerging technologies, leadership, and teamwork in dynamic economic and business environment.
PSO8	**Self-Directed and Lifelong Learning** Engage in independent and life-long learning, especially through MOOCs and other online courses to acclimatize themselves in an ever-changing work environment
PSO9	**Multidisciplinarity** Integrate concepts from multidisciplinary subjectsto enhance their understanding of their principles and effectively apply them in various areas of Economics
PSO10	**Communication Skill and Ethics** Adhere to ethical practices, ensure data integrity, demonstrate environmental awareness and social responsibility in scientific work

PO-CO Mapping

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9	PSO-10
DS-1	✓	✓	✓	✓	✓				✓	✓
DS-2	✓	✓	✓		✓				✓	✓
DS-3	✓	✓		✓	✓				✓	
DS-4	✓	✓	✓	✓	✓				✓	✓
DS-5	✓	✓	✓		✓				✓	✓
DS-6	✓	✓	✓		✓	✓	✓		✓	
DS-7	✓	✓		✓	✓			✓	✓	✓
DS-8	✓	✓	✓	✓	✓				✓	✓
DS-9	✓	✓	✓		✓				✓	✓
DS-10	✓	✓	✓		✓	✓	✓		✓	
DS-11	✓	✓		✓	✓				✓	✓
MA-1/MB-1									✓	
MA-2/MB-2									✓	
MA-3/MB-3									✓	
SM-1/SM-2									✓	
MD-1/MD-2/MD-3									✓	
AE-1										✓
AE-2										✓
AE-3										✓
SE-1	✓	✓	✓	✓	✓	✓			✓	
SE-2	✓	✓		✓	✓	✓			✓	
SE-3									✓	
VA-1										✓
VA-2										✓

COURSE LEARNING OUTCOME

UNDERGRADUATE MAJOR COURSE (DSC-DEPARTMENT SPECIFIC COURSE)

DS-1
ECODSC101T
INTRODUCTORY MICROECONOMICS

Upon successful completion of this course, students will be able to-
1. Understand the fundamental problems of an economy and optimal allocation of resources to meet the needs of the society.
2. Learn the market clearing mechanism for setting up equilibrium price and quantity depending on the demand and supply structures from aggregate to disaggregate unit level.
3. Learn how various economic agents such as, consumers; firms etc. behave rationally to optimize their goals given the economic resources.
4. Understand the short run and long run behaviour of firms in a given demand condition under perfectly competitive set up.

DS-2
ECODSC202T
Introductory Macroeconomics

Upon successful completion of this course, students will be able to-
1. Understand nature, construction and measurement of key macroeconomic variables.
2. Understand the measurement of different components of national income and its importance as an indicator of human wellbeing.
3. Get an idea regarding the determination of income in short run and long run with essential impacts of fiscal and monetary policy variables in different macroeconomic set up (Classical, Simple Keynesian and IS-LM Model

DS-3
ECODSC303T
Mathematical Methods for Economics-1

Upon successful completion of this course, students will be able to-
1. Understand the transmission of basic mathematics that enables the creation of economic theory in general.
2. Understand the application of mathematical techniques to economic theory, in general. *
3. Understand the process of optimization techniques in economic theory, in general. *
4. In this course, particular economic models are not the ends and the material is to be taught as indicated by the contents of the prescribed textbook

DS-3
ECODSC304T
INTERMEDIATE MICROECONOMICS-1

Upon successful completion of this course, students will be able to-
1. Acquire knowledge regarding the short run and long run behaviour of firms in a given demand condition under different imperfectly competitive market set up.
2. Understand how to determine optimal price and employment of an input in different market structures and the role of the labour union in determining wage rates.
3. Check whether the independent action by each economic agent is consistent while there is interdependence among the economic agents.
4. Know how choice in the face of risk differs from choice in the absence of risk, how to measure and reduce risk.

DS-5
ECODSC305T
INTERMEDIATE MACROECONOMICS-1

Upon successful completion of this course, students will be able to-
1. Understand various alternative theories of output and employment determination in a closed economy in the short run as well as long run, and the role of policy in this context.
2. Understand the causes and effects of different types of inflation and inflation unemployment trade-off in an economy.
3. Understand various theories of output and employment determination in an open economy.

DS-6
ECODSC306T
STATISTICAL METHODS FOR ECONOMICS-1

Upon successful completion of this course, students will be able to-
1.Learn the basic concepts of statistical data analysis
2.Perceive the characteristics of sample data using various methods of statistical measurements
3.Understand the compatibility, consistency, spreadness /concentration among different sets of sample data * understand the degree and direction of association in bivariate set up
4.Learn various important concepts of statistical analysis which has enormous applications such as Time Series, Index Numbers, Vital Statistics.

DS-7
ECODSC307T
DEVELOPMENT ECONOMICS

Upon successful completion of this course, students will be able to-
1. Understand alternative conception of development and their justification.
2. Learn about various stages of growth along with various theories and models and strategy of growth.
3. Understand the basic demographic concepts and their evolution during the process of development along with various theories and model explaining the problems of labour surplus economy.
4. Learn different measures of poverty and inequality and explore the connection between growth & inequality.
5.Link the issues and strategies related with economic development and the question of sustainable development

DS-8
ECODSC308T
INTERMEDIATE MICROECONOMICS-2

Upon successful completion of this course, students will be able to-
1. Have conceptual clarity to the student coupled with the use of mathematical tools and reasoning.
2. Know the strategic behaviour oligopolistic firms
3. Understand market failure
4. Learn about general equilibrium and welfare, imperfect markets and topics under information economics.

DS-9
ECODSC309T
INTERMEDIATE MACROECONOMICS-2

Upon successful completion of this course students will be able to-
1. Have an idea about the long run dynamic issues like growth and technical progress.
2. Gather knowledge about the micro-foundations to the various aggregative concepts used in the previous courses.

3. Evolution of economic thoughts and recent development in macroeconomic concepts with special reference to Real Business Cycle and New Keynesian Economics.

DS-10

ECODSC310T

MATHEMATICAL METHODS FOR ECONOMICS-2

Upon successful completion of this course, students will be able to-

1. Understand the basic mathematics that enables the creation of economic theory in general.
2. Understand the application of mathematical techniques to economic theory specifically the courses on microeconomic theory, macroeconomic theory, statistics and econometrics set out in this Syllabus.
3. Understand the application of linear Programming Problems, interdependence industry relation and game theory.
4. In this course, particular economic models are not the ends, but the means for illustrating the specific methods of applying mathematical techniques to economic theory.

DS-11

ECODSC311T

INDIAN ECONOMY

Upon successful completion of this course, students will be able to-

1. Basic characteristics of India economy with respect to structural change, growth and distribution, savings and investment, sustainability and regional contrasts
2. The rational and major objectives of Planning and how the emphasis of those objectives has changed over time and recent developments The key economic issues related to Indian agriculture, industry, foreign sector, monetary sector, poverty, unemployment and income distribution in post-independence period
3. The changes in the policies of the government in the fields of money market, capital market, public sector and external sector.

SKILL ENHANCEMENT COURSE

SE-1/SE-3

ECOSEC101T/ECOHSE303M

SURVEY METHODOLOGY

Upon successful completion of this course, students will be able to-

1. Learn the methodologies of data collection through field surveys.
2. Adopt ideas on large scale sample survey methods and theoretical measurement issues including the scaling techniques.
3. Learn different methods of data collection and their relative importance.
4. Prepare project report by using proper survey methodologies.

SE-2

ECOSEC202T

INDIAN OFFICIAL STATISTICS

Upon successful completion of this course, students will be able to-

1. Understand different official Statistics of India and the collection methods.
2. Evaluate how the structure of Indian economy has changed by analysing secondary data set.
3. Get ideas on Indian official organizations associated with collection, compilation and publication of data set at the national/state and even regional level

MULTIDSCIPLINARY COURSE (MDC)

MD-1
ECOMDC101T
UNDERSTANDING ECONOMICS

Upon successful completion of this course, students will be able to-

1. Understand the scope of economic, economic stem and its functioning
2. Conceptualize the problem of scarcity and the allocation of resources
3. Comprehend two pillars of Economics and theoretical bases.
4. Learn an overview of Indian economic system with a special emphasis on Indian financial system.

Program and Course Learning outcome of Undergraduate and Post Graduate course

Department of Education

BIDHANNAGAR COLLEGE

SALT LAKE

INTRODUCTION

The B.A. Major in Education under the NEP 2020 syllabus at West Bengal State University is a dynamic undergraduate program designed to equip students with both foundational and advanced insights into educational theory, practice, and research. Structured around the tenets of the National Education Policy, the four-year Honours course emphasizes multidisciplinary learning, critical engagement, experiential components, and holistic development. Students explore core areas such as philosophical and sociological underpinnings of education, educational psychology, curriculum design, assessment techniques, educational technology, policy studies, and inclusive practices. The curriculum integrates hands-on experiences through school internships, micro-teaching sessions, field visits, and community-based projects, fostering reflective pedagogy and real-world application. With rigorous coursework, seminars, workshops, and research projects led by experienced faculty, participants develop a strong grounding in analytical thinking, pedagogical skills, and ethical leadership. The program also prioritizes the cultivation of soft skills, digital literacy, and global citizenship values in alignment with NEP's emphasis on 21st-century competencies. By blending theory, practice, and innovative teaching methodologies in a comprehensive, learner-centric environment, the B.A. Major in Education at West Bengal State University prepares graduates to excel as educators, curriculum designers, educational administrators, policy analysts, or further scholars in education, committed to transformative and inclusive learning in diverse school and community settings.

The M.A. course in Education at Bidhannagar College, Salt Lake, is a comprehensive postgraduate program designed to equip students with in-depth knowledge of educational theory, research, and practice. Affiliated with West Bengal State University, the course focuses on fostering critical thinking, pedagogical skills, and academic research abilities among aspiring educators and scholars. It covers a wide range of subjects including philosophical and sociological foundations of education, educational psychology, curriculum studies, educational technology, and policy analysis. Through a balanced mix of theoretical instruction and practical application, the program aims to prepare students for diverse career paths in teaching, educational administration, curriculum development, and research. The department emphasizes academic rigor, reflective inquiry, and inclusive education practices, encouraging students to engage with contemporary issues in education both at the national and global levels. The course is supported by experienced faculty, interactive learning environments, and access to educational resources that enable a deeper understanding of the evolving field of education. Ideal for graduates with a background in Education or related disciplines, the M.A. in Education at Bidhannagar College serves as a strong foundation for those seeking to contribute meaningfully to the academic and professional domains of education.

Under Graduate Program and Course Learning Outcomes

Course Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

Program Outcomes	
PO-1	Display the understanding of the basic concepts, principles and theories of Education
PO-2	Explore the critical analysis of educational implications of specific schools of philosophy including both Western and Indian as well as the history and evolution of Education in India
PO-3	Demonstrate reflective thinking and applications of psychological theories and practices in various field of Education including Special education, Inclusive education, Guidance and counselling
PO-4	Analyse the various aspects of teaching-learning process (Pedagogy) including the basic concepts related to Teacher Education and Curriculum studies
PO-5	Demonstrate analytical reasoning about various socio-political issues related to the field of Education including Women education and Environmental education
PO-6	Recognise the basic managerial skills related to educational administration and leadership qualities
PO-7	Display the concepts of basic research skills and evaluation in Education including the skills related to Educational Statistics
PO-8	Exhibit knowledge to cultivate a better understanding of Value Education, Peace Education and Life Skill Education enabling to demonstrate moral and ethical awareness
PO-9	Display competency related to the basics of Educational Technology and its application in Education
PO-10	To enable students to develop team spirit with an initiation to create link between learning and experience

Program Specific Outcomes	
PSO-1	display the understanding of the basic concepts, principles and theories of Education
PSO-2	explore the critical analysis of educational implications of the concepts, principles and theories of Education
PSO-3	demonstrate reflective thinking and analytical reasoning in pertaining to issues related to Education
PSO-4	analyse the various aspects of skill related issues in relation to Education
PSO-5	exhibit knowledge to cultivate a better attitude and understanding of the issues related to Education
PSO-6	to enable students to develop team spirit with an initiation to create link between learning and experience
PSO-7	Integrate concepts from multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas.
PSO-8	Develop communicative skill and human values.

PO-CO Mapping

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
DS-1	√	√	√		√			
DS-2	√	√	√		√			
DS-3	√	√	√	√	√			
DS-4	√	√	√		√			
DS-5	√	√	√	√	√			
DS-6	√	√	√	√				
DS-7	√	√		√		√		
DS-8	√	√	√	√	√			
DS-9			√		√			
DS-10			√		√			
DS-11	√	√	√	√	√	√		
DS-12	√	√	√	√	√			
DS-13	√	√	√	√	√			
DS-14	√	√	√	√	√			
DS-15	√	√	√	√		√		
DS-16	√	√	√	√				
DS-17	√	√	√	√	√			
DS-18	√	√	√	√	√			
DS-19	√	√	√	√	√			
DS-20	√	√	√		√			
DS-21	√	√	√		√			
SEC 1				√		√		
SEC-2				√		√		
SEC-3							√	
MD-1/MD-2/MD-3							√	
MA-1/MB-1							√	
MA-2/MB-2							√	
MA-3/MB-3							√	
SM-1/SM-2							√	
AE-1								√
AE-2								√
AE-3								√
VA-1								√
VA-2								√

COURSE LEARNING OUTCOME

MAJOR COURSES IN EDUCATION (DSC – Department Specific Course)

DS-1
EDUDSC101T
EDUCATIONAL PHILOSOPHY
(Credit: 5)

On completion of this course, students will be able to:

- Define Education and understand the modern concept of Education.
- Develop an understanding of the aims that influence education and the role they play in shaping the educational process.
- Compare and contrast individualistic and socialistic aims of education.
- Gain insights into the relationship between Education and Philosophy and its implications for educational practices.
- Comprehensive understanding of different schools of Indian & Western philosophy and their relevance to education.
- Analyze the educational implications of specific Indian & Western philosophical schools.
- Explain the concept of child-centric education and its significance in modern educational contexts.
- Recognize the features and significance of life-centric education and its impact on holistic development.
- Understand the contribution of great educators & their philosophies of education

DS -2
EDUDSC202T
EDUCATIONAL PSYCHOLOGY
(Credit: 5)

- Define and explain the concept of psychology and its connection to education.
- Describe the nature and scope of educational psychology and its role in enhancing teaching and learning processes.
- Analyze the neuro- physiological bases of human behaviour.
- To know about structure & function of human brain & neuron, synaptic transmission.
- Explain the concept sensation & perception
- Explain the concepts of growth and development and their significance in education.
- Identify and compare the different types of human development.
- Apply the principles of development to understand the patterns and processes of growth
- Define learning and its significance in educational contexts.
- Identify and evaluate the factors that influence learning outcomes.
- To know about different factors affecting learning process.
- Compare and contrast different theories of learning, such as trial and error, classical conditioning, operant conditioning, insightful learning, and Gagne's theory of learning.

DS-3
EDUDSC303T
PEDAGOGY
(Credit: 5)

- The students will be able to understand the concept Pedagogy as a Discipline.
- The students will be able to understand the concept of Pedagogy & its different perspectives.

- The students will be able to understand the Philosophical, Sociological & Psychological bases of Pedagogy.
- The students will be able to understand the relationship between teaching & learning.
- The students will be acquainted with contemporary issues of pedagogy & its application

DS-4
EDUDSC404T
EDCATIONAL SOCIOLOGY
(Credit: 5)

The students will able to understand the
- Meaning of Sociology and its different perspectives related to Education.
- The relationship between Education and Sociology.
- The concept of culture and its relationship with Education.
- The concept of National Integration & International Understanding.
- Idea of Social Development and Role of Education.
- Connection with some Social Issues in Education.

DS-5
EDUDSC405T
EDUCATIONAL MANAGEMENT
(Credit: 5)

On completion of this course, students will be able to:
- Explain the concept, nature, scope, types of educational management and its need in our life.
- Have an idea about the nature, scope and significance of leadership in management.
- Have an idea about the characteristics of an effective leader in education and the concept of total quality in educational management.
- Have an idea about the agencies of educational management in India
- Have an idea about planning, resource management in education and Management Information System.

DS-6
EDUDSC406T
BASICS OF EDUCATIONAL RESEARCH AND EVALUATION
(Credit: 5)

On completion of this course, students will be able to:
- Explain the concept and types of research and define research related terminologies.
- Define sampling and research hypothesis; explain the different types of sampling.
- Explain the concepts of evaluation and measurement in education.
- Explain the different scales of measurement.
- Define test and explain the different types of tests.
- Explain the concepts of reliability and validity

DS-7
EDUDSC407M
STATISTICS IN EDUCATION & STATISTICS PRACTICAL
(Credit:5)

- Develop the basic concept of Statistics
- Organize and tabulate data
- Learn about descriptive statistics

- Will know the calculation of Inferential Statistics
- Know about data Collection
- Explore the method of data Analyses by any excel/ software and manual both
- Gather experience about statistical report writing

DS- 08
EDUDSC508T
GUIDANCE AND COUNSELLING
(Credit: 5)

- Will develop the basic concept of Guidance and Counselling.
- Will understand the concepts of adjustment and maladjustment.
- Will understand the types of mal-adjustive behaviour in adolescents.
- Will have an idea about mental disorder.
- Will have an idea about the need of data and testing in guidance and counselling.

DS-9
EDC DSC509T
EDUCATION IN PRE-INDEPENDENCE INDIA
(Credit: 5)

The students will able to understand the —

- Scenario of education in Ancient and Medieval India.
- Position of Education under East India Company.
- The development of Education under British Rule.
- Concept of Education from 1917-1947.

DS-10
EDCDSC510T
EDUCATION IN POST-INDEPENDENCE INDIA
(Credit: 5)

The students will able to understand the

- Development of Education from 1947-1953
- Concept of Education from 1964-1968
- System and Position of Education from 1986-1992.
- The development of Education from 1993 onwards.

DS-11
EDCDSC511T
CONTEMPORARY ISSUES
(Credit: 5)

The students will able to understand the

- Traditional Issues, Social Issues and Educational Issues of Indian Educational System.
- The Philosophical, Psychological & Historical importance of the places.
- The proper planning, execution of journey and report writing.
- The link between their learning with experience.

DS-12
EDUDSC612T
COURSE WOMEN EDUCATION
(Credit: 5)

After completion of the course, the students will be able to-

- Understand the meaning, nature scope and necessities of women Education.
- Develop a concept of the historical development of Women Education in India
- Understand the probable remedial measures to solve the problems of Women Education and role of teacher in popularizing Women Education.
- Acquaint with the Women Rights in India.

DS-13
EDUDSC613T
TEACHER EDUCATION
(Credit: 5)

After completion of the course, the students will be able to –

- develop the concept, nature, types, objectives of Teacher Education.
- understand the functions and characteristics of an ideal teacher
- acquaint with the concept of teaching as a profession
- acquaint with the development of Teacher Education in India.
- acquaint with the different models and methodologies of Teacher Education

DS-14EDUDSC614T
LIFE SKILL EDUCATION
(Credit: 5)

After completion of the course, the students will be able to know –

- The concept, types, characteristics and necessities of Life Skills and Life Skill Education
- Role of the Agencies of Education in Life Skill Education
- Different issues in Life Skill Education
- Various Acts related to Life Skill Education

DS-15
EDUDSC615M
EDUCATIONAL TECHNOLOGY & BASIC ICT
(**Credit: 5**)

After completion of the course the students will be able to know and understand

- The concept, nature, scope, limitation & approaches of Educational Technology.
- The concept, components, classification &barriers of Communication.
- The basic class-room oriented model of communication.
- The mass instructional techniques & personalized instructional techniques
- The basic concept of Computer & its components
- The basic operations of MS Word.
- The basic operations of MS Excel
- The process of Slide making & Report Writing
- The concept, nature, scope, limitation & approaches of Educational Technology.

DS 16
EDUDSC716T
CURRICULUM STUDIES
(Credit: 5)

After completion of the course the students will be able to understand –

- The concept, nature & scope of curriculum.
- The relationship among Syllabus, Content & Curriculum.

• Brief introduction about different types of curriculums
• Basic sources of Curriculum construction.
• The need to form aims & objectives of Curriculum.
• The Bloom's Taxonomy of Educational Objectives (Cognitive Domain only).
• The factors of Curriculum Development.
• The meaning & purpose of evaluation of curriculum.
• The approaches to Curriculum Evaluation.

DS-17
EDUDSC717T
SPECIAL EDUCATION
(Credit: 5)

After completion of the course the students will be able to understand –
• The basic concept of special education
• The history & development of Special education in India.
• The idea about Gifted & Slow Learners.
• The about different types of exceptionalities.

DS-18
EDUDSC818T
INCLUSIVE EDUCATION
(Credit: 5)

On the completion of the course, the student will be able to –
• Understand the concept of inclusive education • Develop the concept of adult and social education
• Understand the concept and importance of special education
• Develop an awareness about the issues in inclusive education

DS-19
EDUDSC819T
ENVIRONMENTAL EDUCATION
(Credit: 5)

On the completion of the course, the student will be able to –
• Develop an idea about environmental education
• Develop the concept of eco system and its types, components
• Develop an idea about environmental pollution
• Be aware about the environmental hazards

DS-20
EDUDSC820T
VALUE EDUCATION
(Credit: 5)

On the completion of the course, the student will be able to –
• Understand the meaning, nature and importance of values.
• Develop an idea about values from different perspectives
• Develop an understanding of the concept of value crisis
• Develop an understanding of the concept of value education

DS-21
EDUDSC821T
PEACE EDUCATION

(Credit: 5)

On the completion of the course, the student will be able to –
• Develop an idea about peace and peace education
• Understand the barriers of peace education
• Familiarize with the factors responsible for disturbing peace in an individual
• Understand the need for peace education in the present situation

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
EDUHSE101M/ EDUHSE303M
SKILL DEVELOPMENT FOR SOCIAL AWARENESS
(Credit: 3)

• The students will be acquainted with the concept of social awareness, social backwardness & social advancement.
• Students will know how to plan & execute social awareness programme.
• The students will understand the relationship among IQ, EQ & Social awareness.
• The students will understand how to organize & participate in a social awareness programme.
• The students will understand how to write a report on the social awareness programme.

SE-2
EDUHSE202M
DEVELOPMENT OF OBSERVATIONAL SKILL
(Credit: 3)

• The students will be able to know the concept of Observation, classification of Observation & its advantages and disadvantages.
• The students will be able to know how to plan & execute observational skills.
• The students will be able to know how to record & interpret observed data

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3
EDUHMD303T
INTRODUCTION TO EDUCATION
(Credit: 3)

• Demonstrate a clear understanding of meaning, nature & scope of Education.
• Analyze the aims of education from both individualistic & socialistic perspectives. • Evaluate the functions that shape the field of education.
• Recognize the different forms of education i.e., formal, informal & non-formal forms of Education.
• Develop the concept of Open Education, its characteristics & importance.
• Develop the concept of Distance Education, its characteristics & importance.
• Develop curriculum construction skills based on established principles.
• Recognize the co-curricular activities & its importance in Education.
• Implement child –centric education to promote holistic development

Post Graduate Program and Course Learning outcome

Course offered

Semester I Total Credit: 22	Semester II Total Credit: 22	Semester III Total Credit: 24	Semester IV Total Credit: 24
Departmental 1, Departmental 2, Departmental 3, Departmental 4, Departmental 5, AECC	Departmental 6, Departmental 7, Departmental 8, Departmental 9, Departmental 10, SEC	Departmental 11, Departmental 12, Departmental 13, Departmental 14, Departmental 15, GEC	Departmental 16, Departmental 17, Departmental 18, Departmental 19, Departmental 20 & 21,

PROGRAMME OUTCOMES	
PO1:	display the understanding of the basic concepts, principles and theories of Education as a discipline, system and a process
PO2:	explore the critical analysis of educational implications of specific schools of philosophy including great educators including both Western and Indian
PO3:	demonstrate reflective thinking and applications of psychological theories and practices in various field of Education including Children with diverse needs, Guidance and
PO4:	analyse the various aspects of Pedagogy including the basic concepts related to Teacher Education and Curriculum studies
PO5:	demonstrate analytical reasoning about various contemporary and sociological issues related to the field of Education
PO6:	recognise the basic managerial skills related to educational administration and leadership qualities
PO7:	display the concepts of basic research skills and evaluation in Education including the skills related to Educational Statistics
PO8:	exhibit knowledge to cultivate a better understanding of Value Education and Peace Education enabling to demonstrate moral and ethical awareness
PO9:	display competency related to the basics of Educational Technology and its application in Education
PO10:	to enable students to develop team spirit with an initiation to create link between learning and experience

PROGRAM SPECIFIC OUTCOMES	
PSO1:	develop knowledge and understanding of major specialized areas in Education.
PSO2:	develop critical thinking pertaining to issues related to Education.
PSO3:	orient the students on the modern trends of Educational Technology and their application in educational system.
PSO4:	enhance the necessary competencies to provide better inclusive classroom environment to accommodate various categories of the students.
PSO5:	develop competencies to conduct research in emerging areas of Education.
PSO6:	develop knowledge and understanding of the process of educational research.
PSO7:	develop communication skill
PSO8:	Develop multidisciplinary knowledge

PROGRAMME & COURSE OUTCOMES MAPPING

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
D-1	√	√			√			
D-2	√	√		√	√			
D-3		√			√	√		
D-4	√	√						
D-5			√		√			
D-6	√	√		√	√			
D-7	√	√	√	√	√			
D-8	√		√		√	√		
D-9	√		√	√	√	√		
D-10	√	√		√	√		√	
D-11	√	√	√	√	√			
D-12	√	√		√	√			
D-13	√	√		√	√			
D-14	√	√	√	√	√			
D-15					√	√		
D-16	√	√	√	√	√			
D-17	√	√	√		√			
D-18	√	√			√	√		
D-19	√	√			√	√		
D-20					√	√		
AECC							√	
SEC							√	
GEC								√

COURSE LEARNING OUTCOME

CORE COURSES

D-1
EDCPCORO1T
Philosophical Foundations of Education

After the completion of the course, the students will be able to –

- recognize the importance and significance of Education, Philosophy and Educational Philosophy.
- understand the contributions of Indian & Western Schools of Philosophy in Education.
- appreciate the contributions of Educational Thinkers.

D-2
EDCPCORO2T
Psychological Foundations of Education

After the completion of the course, the students will be able to –

- understand the concept and significance of schools of psychology.
- understand the various aspects of Growth and Development.
- understand the concept, nature of intelligence and creativity.
- Understand the theories of intelligence and emotional intelligence
- understand the concept, development, measurement, importance and theories of personality.

D-3
EDCPCORO3T
Methodology of Educational Research

After the completion of the course, the students will be able to –

- comprehend the nature and process of understanding research in Education
- understand various research designs in Education
- understand analysis of data and research report writing
- plan and design Educational Research

D-4
EDCPCOR04T
Contemporary Issues and Trends in Education

After the completion of the course, the students will be able to –

- acquaint with the meaning, nature and needs of reservation in Education.
- understand various issues in Education.
- recognize the trends in Education.
- understand the growth and development of education in free India

D-5
EDCPCORO5P
PRACTICAL - ICT in Education

After the completion of the course, the students will be able to –

- familiarize with the basic ideas of computer and its functions & importance in Education
- operate MS words and its different uses
- Operate Excel and its Different Uses
- Operate PPT and its Different Uses

D-6

EDCPCORO6T

Sociological Foundations of Education

After the completion of the course, the students will be able to –

- understand the relationship between Education and Sociology.
- Understand the approaches to sociology of education and theories of social movements
- understand culture, socialization and social process.
- recognize social change properly.
- analyze the causes and remedial measures of various social problems.

D-7

EDCPCORO7T

Pedagogical Studies

After the completion of the course, the students will be able to –

- understand concept, nature and importance of Pedagogy and Pedagogical analysis.
- understand the concept, nature and theories of Andragogy.
- familiarize with the assessment in Pedagogy of Education.
- familiarize with the assessment in Andragogy of Education.

D-8

EDCPCORO8T

Statistics in Education

After the completion of the course, the students will be able to –

- understand the basic concept and need of statistics in educational research.
- understand quantitative data analysis.
- acquaint with parametric and non- parametric inferential analysis.
- understand qualitative data analysis.

D-9

EDCPCOR09P

PRACTICAL - Development of a Standardized Achievement Test

After the completion of the course, the students will be able to –

- understand how to develop a standardized achievement test.
- acquaint with the implications of standardized achievement test in Education.

D-10

EDCPCOR10T

Psychology of Learner & Learning Process

After the completion of the course, the students will be able to –

- Understand various theories of learning
- Acquaint with learning & motivation.
- Understand transfer of learning.
- Acquaint with social learning

D-11

EDCPCOR11T

Educational Technology

After the completion of the course, the students will be able to –

- develop the general ideas on Educational Technology
- understand the meaning, nature & importance of system approach and various applications of Computer in Education.
- acquaint with the emerging trends in e-learning.
- understand the uses of ICT in different sectors, advantages & disadvantages of ICT.

D-12

EDCPCOR12T

Educational Management

After the completion of the course, the students will be able to –

- understand the functions & importance of management, administration and Educational Management.
- acquaint with the concept of leadership in the field of Education.
- understand quality management in Education.
- develop the ideas regarding the changes in management.

D-13

EDCPCOR13T

Value & Peace Education

After the completion of the course, the students will be able to –

- develop the concept, need and importance of Value and Peace Education.
- acquaint with the nature & concept of value Education.
- acquaint with the nature & concept of Peace Education.
- understand the approaches to Education in value and peace.

D-14

EDCPCOR14P

PRACTICAL- Evaluation of Listening & Speaking Skills

After the completion of the course, the students will be able to –

- understand how to develop listening skills
- understand how to develop speaking skills
- understand how to conduct field survey or community survey

D-15

EDCPCOR15T

Curriculum Studies

After the completion of the course, the students will be able to –

- acquaint with the concept, development & bases of curriculum

- develop the idea on various models of curriculum design
- understand the concept, nature & importance of curriculum evaluation
- understand the concept, need, factors & approaches of curriculum change

D-16

EDCPCOR16T

Education of Children with Diverse Needs

After the completion of the course, the students will be able to –

- develop the concept, evolution, scope of Inclusive Education and Education of Children with Diverse Needs.
- understand the types, causes & prevention of Diverse learners.
- understand the planning and management of diverse learners.
- acquaint with the barriers and facilitators in Inclusive Education.

D-17

EDCPCOR17P

PRACTICAL - Review of Related Literature on a given topic

After the completion of the course, the students will be able to –

- learn the significance of the Review of Related Literature
- learn how to find out a relevant literature
- learn to review a literature

D-18

EDCPCOR18P

PRACTICAL- Dissertation / Project

After the completion of the course, the students will be able to –

- learn how to collect data learn
- how to analyse the data
- develop the art of writing project report
- understand the process of presentation and defence of Project

DEPARTMENT SPECIFIC COURSES

EDCPDSE01T

Guidance & Counselling

After the completion of the course, the students will be able to –

- understand the nature, principles, need and types of guidance
- understand the nature, principles, need and types of counselling
- develop the various guidance programme in different levels
- acquaint with stress and stress management

EDCPDSE02T

Teacher Education

After the completion of the course, the students will be able to –

- develop the concept, nature, types, approaches of Teacher Education.
- understand the concept, scope, organization & agencies of in-service teacher education.
- acquaint with the concept of professionalism in education.
- acquaint with the modern trends in Teacher Education.

SKILL ENHANCEMENT COURSE

SEC
EDCPSECO1P
Practical - Communication Skills

After the completion of the course, the students will be able to –

- understand how to develop reading skill
- understand how to develop writing skill

ABILITY ENHANCEMENT COURSE

AECC
EDCPAEC01M
COMMUNICATIVE ENGLISH

After the completion of the course, the students will be able to -

- understand different types of non-verbal and oral communication and their uses in various educational sectors.
- acquaint with different types of writing capabilities
- develop communication skill in different sectors of life.

Program and Course Learning outcome of Undergraduate course

Department of English

BIDHANNAGAR COLLEGE

SALT LAKE

INTRODUCTION

The B.A. Major in English under the NEP 2020 syllabus at West Bengal State University is a robust four-year honors program that immerses students in a rich blend of British, American, European, and Indian literature, while fostering strong linguistic, critical, and communicative competencies. Through core courses such as British Poetry & Drama (14th–17th and 18th–19th centuries), Indian Classical Literature, Postcolonial and South Asian Fiction, and a dissertation-based final year, the curriculum is built on a foundation of literary history, theory, and critical inquiry. Complementing these are essential components in English Communication, Linguistics, Translation Studies, and Environmental Humanities, all aligning with NEP's learner-centric and interdisciplinary vision. Students' development is further enriched by seminars, presentations, internships, and workshops designed to hone analytical writing, oral fluency, and research skills. Graduates emerge with a nuanced appreciation of literature across cultures and periods, equipped for diverse careers such as teaching, content creation, publishing, media, and further academic research in literary and language studies.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

Programme Outcomes	
PO1	**Concept Building:** Students completing B.A. (Major in English) Programme will be able to learn the basic concepts of English Language, the history of the language and they will surely attain love and respect towards English language, mostly their second language.
PO2	**Knowledge:** After the completion of the course, the students will gain knowledge about English Literature, it's vast landscape and multicultural, multi religious aspects.
PO3	**Ethical and civic responsibility:** Students will be trained to understand ethical principles and personal values, through Literature, including the ability to engage in informed and ethical decision-making.

Programme Specific Outcomes	
PSO1	Concept: students will understand the basics of English Literature and language; particularly concepts in Classical Literature, British Literature, American Literature, Translation, Language and Linguistics, ELT, Media Writing, Editing and Proofreading, Communication Skills and Professional Writing.
PSO2	Societal value systems: Literature that has been created at the fissures, at the hands of those who were not encouraged to write or published. Especially in a sub continental classroom, where students arrive at the intersection of class, caste and religion, it is absolutely mandatory to understand the language of dissent, class struggle and non-canonical forms of writing.
PSO3	Multi-skill development: Students will engage with **world literature**, and will be able to do comparative analysis. Students will demonstrate proficiency in **linguistic assessments** and achieve **accuracy** in syntax and stylistic analysis.
PSO4	Industry relevance: Students will be able to compose **structured essays**, maintaining coherence and clarity.
PSO5	Critical thinking: Students will critically analyse **many canonical texts** and demonstrate proficiency in thematic and stylistic evaluation.
PSO6	Multi-cultural competence:
PSO7	Research related skill: Students will produce **research papers**, maintaining **citation accuracy** in referencing scholarly sources
PSO8	Employment related skill: Students will engage with **world literature**, and will be able to do comparative analysis.
PSO9	Multidisciplinary knowledge: Integrate concepts from Multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Language and Literature.
PSO10	Communicative skill moral values: Students will articulate responses to **social and ethical issues** through literary discourses and develop communicative skills.

Undergraduate Program and Course Outcome Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
DS1			✓	✓				✓		
DS2	✓		✓	✓		✓		✓		
DS3	✓	✓	✓	✓	✓			✓	✓	
DS4	✓	✓	✓	✓	✓			✓	✓	
DS5	✓	✓	✓	✓	✓			✓	✓	
DS6	✓	✓	✓	✓	✓			✓	✓	
DS7	✓	✓	✓	✓	✓	✓		✓	✓	
DS8	✓	✓	✓	✓	✓			✓	✓	
DS9	✓	✓	✓	✓	✓	✓	✓	✓	✓	
DS10		✓	✓		✓	✓	✓	✓	✓	
DS11	✓			✓				✓		
DS12	✓	✓		✓	✓	✓	✓	✓	✓	
DS13			✓	✓	✓	✓		✓	✓	
DS14		✓	✓	✓	✓	✓		✓	✓	
DS15	✓	✓			✓	✓	✓	✓	✓	
DS16	✓	✓		✓	✓	✓	✓	✓	✓	
DS17		✓	✓		✓	✓	✓	✓	✓	
DS18	✓		✓		✓	✓	✓		✓	
DS19	✓	✓			✓	✓	✓		✓	
DS20	✓	✓	✓		✓	✓			✓	
DS21		✓			✓	✓	✓		✓	
MA-1/MB-1									✓	
MA-2/MB-2									✓	
MA-3/MB-3									✓	
SM-1/SM-2									✓	
AE-1										✓
AE-2										✓
AE-3										✓
SE-1	✓									
SE-2	✓		✓							
SE-3									✓	

UNDER GRADUATE COURSE OUTCOME

DEPARTMENT SPECIFIC COURSE (DSC)

DS-1
ENGDSC101T
HISTORY OF ENGLISH LITERATURE

Module I: Middle English period to Caroline Age
Module II: Commonwealth, Restoration & Neoclassical period
Module III: Age of Transition to Romantic period
Module IV: Victorian period
Module V: Modern period up to 1960s

COURSE OUTCOMES:

1.Comprehending Literary Evolution: Students will trace the historical development of English literature from the Middle English period to the 1960s, identifying key movements, authors, and texts that shaped literary discourse.
2. Analyzing Socio-Political Contexts: Learners will explore the impact of historical events—such as the Commonwealth, Restoration, and Industrial Revolution—on literary themes, genres, and stylistic innovations.
3. Examining Literary Transitions: Through comparative study, students will evaluate the shifts from Neoclassicism to Romanticism, and later from Victorian realism to Modernist experimentation, recognizing how literary conventions evolve.
4. Interpreting Canonical Texts: Students will critically engage with representative works from each period, analyzing themes, language, and narrative techniques within their historical and philosophical contexts.
5. Applying Literary Perspectives: Learners will develop informed perspectives on literature's role in shaping intellectual and cultural discourse, enhancing their ability to contextualize texts within broader societal narratives.

DS-2
ENGDSC202T
HISTORY OF ENGLISH LANGUAGE & LITERARY TERMS

GROUP A: History of English Language
Module I
Indo-European family of Languages
Grimm's Law, Verner' Law
Scandinavian Influence
French Influence
Latin & Greek Influence
Influence of The Bible
Influence of Shakespeare
Influence of Globalisation
Short Notes:
Native resources; Hybridism; Journalese; Malapropism; Monosyllabism; Back- formation; Free and Fixed Compounds
Module II
Understanding of the formation of Indian English words through the processes of Loan words, Loan translations, Hybridism, Adaptations, Diffusions (only word notes): peon, guru, lathi-charge, tiffin-box, military hotel, 420, communal, out of station, batchmate, match box, eve-teasing, karma, hartal, almirah, gherao, avatar

GROUP B: Literary Terms
Terms related to Poetry -rhyme, meter, image, symbol, conceit, stanza pattern, couplet, poetic license
Terms related to Drama - aside, dramatic irony, three Unities, chorus, hubris, hamartia, catharsis, Freytag ‘s pyramid
Terms related to Fiction - flat character, round character, plot, point of view, epistolary technique, stream of consciousness, narrator, narrative structure

COURSE OUTCOMES:

1. Tracing Linguistic Evolution: Students will understand the historical development of the English language, exploring its roots in the Indo-European family and key linguistic shifts influenced by Grimm’s and Varner’s Laws.
2Analyzing Cultural Influences: Learners will examine the impact of Scandinavian, French, Latin, and Greek influences on English vocabulary, syntax, and literary expression.
3. Investigating Language Formation: Through the study of Indian English words and linguistic processes like loan words, hybridism, and adaptations, students will identify the dynamic nature of language evolution.
4. Applying Literary Terminology: Students will develop a strong grasp of essential literary terms across poetry, drama, and fiction, enabling effective analysis and interpretation of literary texts.
5. Contextualizing Global and Literary Impact: Learners will explore how literature, globalization, religious texts, and major authors—such as Shakespeare—contributed to shaping the English language and literary traditions.

DS3
ENGDSC303T
BRITISH LITERATURE (14th– Early 17th C)

Background study:
The historical, political, socio-cultural background, literary & intellectual details
The generic & social history of poetry and poetic forms
The development of English drama on the Elizabethan and Jacobean stage
Renaissance Humanism
The Stage, Court and City
Religious & Political Thought and Reformation
Prose-writers
Module I
i) Geoffrey Chaucer - Prologue (lines 1-42)
ii) Francis Bacon - Of Studies
Module II
Poetry: Elizabethan Sonneteers
Wyatt– Farewell Love and all thy Laws forever
Sidney – Loving in Truth
Spenser – One day I wrote her name
Module III
Shakespeare - Sonnets: 30, 116, 130
Donne –The Canonization
Marvell –To His Coy Mistress
Module IV
Drama:
William Shakespeare-Macbeth
Module V
Drama:
William Shakespeare- Twelfth Night

COURSE OUTCOMES:

1. **Exploring Historical and Intellectual Contexts:** Students will analyze the socio-political and cultural background of early British literature, including Renaissance Humanism and the evolution of poetic and dramatic forms.
2. **Developing Critical Perspectives on Poetry:** Learners will engage with key Elizabethan and Jacobean poets, examining themes of love, mortality, and artistic expression through close readings of sonnets and metaphysical poetry.
3. **Understanding the Evolution of Drama:** Through the study of Shakespearean tragedies and comedies, students will explore structural and thematic elements that defined Elizabethan and Jacobean theater.
4. **Interpreting Literary Prose and Philosophical Thought:** By engaging with works such as Bacon's *Of Studies* and Chaucer's *Prologue*, learners will evaluate early styles and their role in shaping intellectual discourse.
5. **Applying Literary Analysis to Canonical Texts:** Students will develop interpretative skills to assess major literary works, considering their influence on subsequent literary traditions and their relevance to contemporary scholarship.

DS 4
ENGDSC404T
BRITISH POETRY & DRAMA (17th -18th C); RHETORIC & PROSODY

Background Studies: History, politics and socio-cultural background, religious & secular thought in the 17th century, its impact on literature. Poetry with special reference to the change and the emergence of new forms and styles, verse satires, neoclassical norms, emergence of mock-epic
Closing and restoration of the stage; court, stage and commercial theatre; women and the theatre; Comedy of Manners and its detractors; beginning of stage reformation and the later playwrights of the Restoration; Dryden and Heroic Tragedy
Module I: Rhetoric & Figurative language
The following figures of speech will have to be taught. Additionally, teachers are free to
teach as far as practicable.
(i) Figures of thought, or tropes
Simile, metaphor, personification, climax, anticlimax, litotes, oxymoron, hyperbole, anaphora, epigram, antithesis, metonymy, synecdoche, pathetic fallacy, innuendo, irony.
(ii) Figures of speech, or ―rhetorical figures, or schemes alliteration, onomatopoeia, pun, hendiadys, rhetorical question, apostrophe,
zeugma, interrogation, transferred epithet, periphrasis, euphemism, chiasmus,
assonance, consonance, inversion, polysyndeton, asyndeton.
Module II:
Prosody – Disyllabic & Trisyllabic feet with variations
Module III:
John Milton - Paradise Lost Book I
Module IV:
Alexander Pope -The Rape of the Lock (Cantos I, II & III)
Module V:
Congreve - The Way of the World

COURSE OUTCOMES:

1. **Understanding Literary and Cultural Shifts:** Students will analyze the socio-political and religious changes that shaped 17th- and 18th-century literature, including the Restoration, emergence of new poetic forms, and theatrical developments.

2. **Examining Rhetorical and Prosodic Elements:** Learners will explore rhetorical devices and figures of speech, recognizing their role in shaping literary expression, and develop an understanding of prosodic variations in poetry.
3. **Analyzing Major Literary Works:** Through critical engagement with *Paradise Lost*, *The Rape of the Lock*, and *The Way of the World*, students will examine themes of satire, heroic tragedy, and poetic conventions.
4. **Tracing the Evolution of Drama and Comedy:** Students will study Restoration drama, with a focus on the Comedy of Manners, the reformation of the stage, and the contributions of playwrights like Congreve and Dryden.
5. **Developing Interpretative and Analytical Skills:** Learners will apply literary frameworks to evaluate texts, understanding the interplay between neoclassical ideals, mock-epic conventions, and the broader intellectual movements of the time.

DS 5
ENGDSC405T
18TH C BRITISH LITERATURE; SUBSTANCE & CRITICAL APPRECIATION

Background study - 18th century as the age of prose and reason; Enlightenment and Neoclassicism; the country and the city; rise of sensibility; the rise of the periodical press and the novel as a genre.
Module I
Substance writing, Critical Appreciation & Stylistic Analysis
Module II
Drama:
Goldsmith - She Stoops to Conquer
Module III
Poetry:
Gray, Elegy Written in a Country Churchyard
Cowper, The Solitude of Alexander Selkirk
Blake, Introduction, The Lamb, The Tyger from Songs of Innocence and of Experience
Module IV
Fiction: Jonathan Swift, Gulliver 's Travels BK.1&2
Module V
Non-fiction:
Addison – Sir Roger at Home
Steele-A Coffee-house and its Frequenters
Goldsmith–Parliamentary Elections

COURSE OUTCOMES:

1. **Understanding Enlightenment Ideals:** Students will analyze the intellectual and literary shifts of the 18th century, exploring how reason, sensibility, and Neoclassicism shaped prose, poetry, and drama.
2. **Developing Critical and Stylistic Analysis:** Learners will enhance their ability to critically appreciate texts, engaging in substance writing and stylistic evaluation of literary works across genres.
3. **Exploring Satire and Social Commentary:** Through *Gulliver's Travels* and periodical essays by Addison, Steele, and Goldsmith, students will examine the role of satire and prose in critiquing societal norms and politics.
4. **Engaging with Poetry and Philosophical Reflection:** Students will interpret major poetic works, including *Elegy Written in a Country Churchyard* and Blake's *Songs of Innocence and Experience*, identifying themes of solitude, morality, and artistic vision.

5. **Understanding the Evolution of Drama and Comedy:** Learners will evaluate Restoration and 18th-century theatrical conventions, focusing on *She Stoops to Conquer* and its reflection of social class, wit, and stage dynamics.

DS-6
ENGDSC406T
BRITISH ROMANTIC LITERATURE (Mid 18th C to Early 19th C)

Backgrounds to Romantic poetry — trends, traditions and techniques and a general overview of poets and their works. Social, political and intellectual developments and their impact on literature; Reason & Imagination; conceptions of man and nature; literature & revolution; the Gothic novel

Module I. Horace Walpole-The Castle of Otranto
Module II: Prose
Charles Lamb: Dream Children; The Superannuated Man
Thomas de Quincey: ‗The Literature of Knowledge and the Literature of Power, Romantic Prose and Poetry, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 740-744
Module III: Poetry I
William Wordsworth- Tintern Abbey
S.T. Coleridge- Kubla Khan
Module IV: Poetry II
P.B. Shelley- Ode to the West Wind
John Keats - Ode on a Grecian Urn
Module V: Fiction
Jane Austen - Pride and Prejudice

COURSE OUTCOMES:

1. Understanding Romantic Ideals: Students will explore the philosophical and artistic foundations of Romanticism, examining themes such as imagination, nature, individualism, and revolution.
2. Analyzing Key Literary Works: Learners will critically engage with poetry, prose, and fiction by Wordsworth, Coleridge, Shelley, Keats, Austen, and others, identifying their stylistic innovations and thematic concerns.
3. Examining the Intersection of Literature and Society: Through historical and intellectual study, students will evaluate how Romantic literature reflects the political, social, and cultural upheavals of its time, including responses to Enlightenment rationalism.
4. Interpreting the Gothic Influence: By studying *The Castle of Otranto*, learners will understand the emergence of the Gothic novel and its impact on literary traditions, particularly its fascination with mystery, the supernatural, and psychological depth.
5. Developing Critical and Contextual Approaches: Students will refine their analytical skills, connecting Romantic literature with broader literary movements and understanding its enduring relevance in contemporary discourse.

DS-7
ENGDSC407T
INDIAN WRITING IN ENGLISH

Module I: Background study— History of Indian Writing in English, its readership, themes and context
Module II: Drama
Girish Karnad - Tughlaq
Module III: Poetry
Tagore – Gitanjali Poem 11 – Leave this chanting and singing
https://www.gutenberg.org/cache/epub/7164/pg7164-images.html

Kamala Das- Introduction
A. K. Ramanujan - Another View of Grace
Jayanta Mahapatra-Hunger
Agha Shahid Ali – The Wolf ‘s Postscript to Little Red Riding Hood
Meena Kandasamy – Aggression
Module IV: Novel
R. K. Narayan - The Guide
Module V: Short Stories
Ruskin Bond - Tiger, Tiger, Burning Bright
Salman Rushdie - The Free Radio
Hansda Sowvendra Shekhar – The Adivasi will not Dance

COURSE OUTCOMES:

1. **Understanding the Evolution of Indian Writing in English:** Students will explore the historical development, themes, and readership of Indian English literature, assessing its role in shaping modern literary discourse.
2. **Analyzing Dramatic and Narrative Techniques:** Learners will critically examine *Tughlaq*, identifying Karnad's exploration of history, political allegory, and dramatic structure within the Indian theatrical tradition.
3. **Interpreting Poetic Voices and Themes:** Students will engage with poetry from Tagore, Kamala Das, Ramanujan, Mahapatra, Agha Shahid Ali, and Meena Kandasamy, exploring themes of identity, spirituality, resistance, and socio-political commentary.
4. **Examining Fictional and Realist Narratives:** Through *The Guide* and selected short stories, learners will assess Indian storytelling traditions, considering themes of morality, self-discovery, and socio-cultural realities.
5. **Developing Critical Approaches to Indian Literature:** Students will refine their analytical skills, contextualizing Indian English literature within global literary movements while recognizing its unique expressions of identity, history, and contemporary issues.

DS-8
ENGDSC508T
19TH CENTURY BRITISH LITERATURE

Background Study: Utilitarianism; The 19th Century Novel; Marriage and Sexuality; The Writer and Society; Faith and Doubt; The Dramatic Monologue
Module I: Prose
Arnold – Excerpt on Touchstone Method from _The Study of Poetry
Wilde – The Nightingale and the Rose
Module II: Novel
Charlotte Bronte – Jane Eyre
Module III: Poetry I
Tennyson-_Ulysses
Robert Browning - _My Last Duchess
Module IV: Poetry II
Matthew Arnold- _Dover Beach
Christina Rossetti -_The Goblin Market
Module V: Novel
Charles Dickens - Great Expectations

COURSE OUTCOMES:

1. **Understanding Literary and Social Contexts:** Students will explore 19th-century literature in relation to key intellectual movements, including Utilitarianism, faith and doubt, and evolving perspectives on marriage, sexuality, and social class.
2. **Examining Prose and Literary Criticism:** Learners will analyze Arnold's *Touchstone Method* and Wilde's *The Nightingale and the Rose*, assessing their contributions to literary criticism and aesthetic philosophy.
3. **Interpreting Poetry and the Dramatic Monologue:** Through close readings of *Ulysses*, *My Last Duchess*, *Dover Beach*, and *The Goblin Market*, students will engage with themes of heroism, psychological depth, societal anxieties, and feminist undertones.
4. **Exploring the 19th-Century Novel:** Students will critically evaluate *Jane Eyre* and *Great Expectations*, identifying the novel's role in shaping character development, realism, and moral narratives within Victorian literature.
5. **Applying Critical Perspectives on Narrative Forms:** Learners will develop analytical skills to assess major works from this period, considering their thematic resonance, historical relevance, and literary innovations.

DS-9
ENGDSC509T
20th Century British Literature

Background Readings:
Modernism, Postmodernism and non-European Cultures, Women 's Movement in the early 20th Century, Psychoanalysis and the Stream of Consciousness, The Uses of Myth, the Avant Garde
Module I: Prose
James Joyce – Araby
Virginia Woolf – Shakespeare 's Sister from *A Room of One's Own*
Module II: Drama
Samuel Beckett – Waiting for Godot
Module III: Poetry I
W.B. Yeats - Sailing to Byzantium
T.S. Eliot - The Love Song of J. Alfred Prufrock
Module IV: Poetry II
Wilfred Owen - Spring Offensive
W.H. Auden - Musée des Beaux Arts
Ted Hughes – Thought Fox
Module V: Novel
Joseph Conrad - Heart of Darkness

COURSE OUTCOMES:

1. **Engaging with Modernist and Postmodernist Literature:** Students will explore major literary movements, including Modernism and Postmodernism, analyzing their impact on themes, style, and narrative experimentation.
2. **Understanding Literary Responses to Social Change:** Learners will evaluate how 20th-century literature reflects societal shifts, such as the Women's Movement, psychoanalysis, and non-European influences.
3. **Interpreting Prose and Narrative Techniques:** Through works like Joyce's *Araby* and Woolf's *Shakespeare's Sister*, students will critically examine stream-of-consciousness narration and feminist literary discourse.
4. **Analyzing Poetry and Symbolism:** Students will study poetic innovations in the works of Yeats, Eliot, Owen, Auden, and Hughes, recognizing their use of myth, modernist imagery, and socio-political themes.
5. **Exploring Experimental Drama and Fiction:** Learners will engage with Beckett's *Waiting for Godot* and Conrad's *Heart of Darkness*, assessing their avant-garde structures and their interrogation of existential and colonial themes.

DS-10
ENGDSC510T
AMERICAN LITERATURE

Module I: Background Study –Short history of American Literature 1776-2001, the American dream, social realism and the American novel, African-American women 's writing, the question of form in American Poetry, American Drama
Module II: Drama
Tennessee Williams - A Street Car Named Desire
Module III: Poetry
Anne Bradstreet – The Prologue
Walt Whitman – Passage to India (lines 1–68)
Langston Hughes – The Negro Speaks of Rivers
Alexie Sherman Alexie – Crow Testament; Evolution
Module IV: Novel
Toni Morrison - Beloved
Module V: Short Stories
Edgar Allan Poe – The Purloined Letter
William Faulkner – Dry September
Nathaniel Hawthorne – The Ambitious Guest

COURSE OUTCOMES:

1. **Tracing the Evolution of American Literature:** Students will explore the historical trajectory of American literary traditions from 1776 to 2001, examining cultural shifts such as the American Dream, social realism, and African-American women's writing.
2. **Understanding Dramatic and Narrative Constructs:** Learners will critically engage with *A Streetcar Named Desire*, analyzing Tennessee Williams' portrayal of psychological depth, gender dynamics, and social tension.
3. **Exploring Poetic Forms and Cultural Expression:** Students will study diverse poetic voices, including Whitman, Langston Hughes, and Sherman Alexie, identifying key themes such as identity, resilience, and national consciousness.
4. **Interpreting Fictional and Psychological Narratives:** Through Morrison's *Beloved* and short stories by Poe, Faulkner, and Hawthorne, learners will assess themes of trauma, morality, race, and gothic elements in American storytelling.
5. **Applying Critical Perspectives to Literary Traditions:** Students will refine their analytical approaches to American literature, connecting thematic explorations with historical movements, political ideologies, and evolving literary forms.

DS-11
ENGDSC511T
LITERARY TYPES & ESSAY WRITING

Module I: Poetry
Module II: Comedy
Module III: Tragedy
Module IV: Novel
Module V: Essay writing

COURSE OUTCOMES:

1. **Understanding Major Literary Genres:** Students will explore fundamental literary types—poetry, comedy, tragedy, and the novel—examining their characteristics, historical development, and thematic significance.
2. **Analyzing Structural and Stylistic Elements:** Learners will study genre-specific features, including poetic devices, dramatic conventions, narrative structures, and rhetorical techniques, enhancing their ability to interpret diverse literary forms.
3. **Comparing Literary Traditions and Evolutions:** Students will evaluate how different literary genres interact and evolve over time, recognizing shifts in style, audience expectations, and cultural impact.
4. **Developing Essay Writing Skills:** Through structured exercises, learners will refine their ability to craft analytical essays, arguments, and literary critiques with clarity, coherence, and well-supported perspectives.
5. **Applying Critical Thinking to Literature:** Students will enhance their ability to assess texts from multiple angles, connecting literary themes to broader cultural, philosophical, and social contexts.

DS-12
ENGDSC612T
LITERARY THEORY

Module I: MARXISM
Marxist model of society- Base & Superstructure
Marxist Literary Criticism
Leninist Marxist criticism/Vulgar Marxist criticism
Engelsian Marxist Criticism/ Russian Formalism
Gramsci - Rule vs Hegemony
Althusser - Ideology; State power/ Repressive structures; State Control/ State Ideological Apparatus/Ideological structures; Interpellation
Module II: POSTCOLONIALISM
The Imperial Turn: Gandhi, Anti-colonial Struggle and the Early Postcolonial
Frantz Fanon and the Psychopathology of Colonialism
Aimé Césaire, Leopold Senghor and Negritude
Edward Said, Orientalism and the Postcolonial Moment
Homi Bhabha, Mimicry and Hybridity in Postcolonialism
Colonial Discourses and English Studies
The Literature of Empire
Language and Imperialism
Module III: FEMINISM
What is Feminism?
'Feminist', 'Female', and 'Feminine'
Feminist literary theory
Three Waves of Women 's Writings
Gyno criticism
Ecriture Feminine
Elaine Showalter
Julia Kristeva
Module IV: STRUCTURALISM
Saussure Signs, Signifier/Signified, Langue and Parole, Poststructuralism, Difference between Structuralism and Poststructuralism
Module V: ECOCRITICISM
Nature and Culture
Literature and Ecology
Wilderness and Pastoral
Environmentalism
Deep Ecology
Ecofeminism

Eco-Marxism & Social Ecology
Rachel Carson, biocide

COURSE OUTCOMES:

1. **Engaging with Theoretical Frameworks:** Students will gain an in-depth understanding of key literary theories, including Marxism, Postcolonialism, Feminism, Structuralism, and Ecocriticism, enabling critical interpretation of texts through diverse perspectives.
2. **Analyzing Socio-Political Influences on Literature:** Learners will explore how literature reflects and responds to issues such as colonialism, class struggle, gender dynamics, ideology, and environmental concerns.
3. **Applying Critical Approaches to Textual Analysis:** Students will develop skills to assess literary works using structuralist, poststructuralist, and Marxist methodologies, recognizing the relationship between language, power, and discourse.
4. **Investigating Feminist and Postcolonial Discourses:** Through engagement with thinkers such as Gramsci, Said, Bhabha, and Kristeva, learners will examine how literary narratives challenge or reinforce cultural and ideological norms.
5. **Exploring Environmental and Ecological Concerns in Literature:** Students will critically evaluate Ecocriticism's role in literary studies, examining themes like deep ecology, ecofeminism, and the impact of environmental movements on literature.

DS13
ENGDSC613T
EUROPEAN DRAMA & THEATRE

Module I: Evolution & Growth of Greek & Roman Theatre
Module II: Sophocles – Oedipus Rex
Module III: Henrik Ibsen- A Doll's House
Module IV: Anton Chekhov – The Cherry Orchard
Module V: Bertolt Brecht -The Good Woman of Setzuan

COURSE OUTCOMES:

1. **Understanding the Evolution of European Theatre:** Students will explore the historical development of Greek and Roman drama, analyzing its foundational influence on later theatrical traditions.
2. **Engaging with Classical and Modern Dramatic Forms:** Learners will critically examine key works like *Oedipus Rex*, *A Doll's House*, *The Cherry Orchard*, and *The Good Woman of Setzuan*, identifying thematic and structural shifts across different periods.
3. **Analyzing Theatrical Techniques and Innovations:** Through the study of Sophoclean tragedy, Ibsen's realism, Chekhovian drama, and Brecht's epic theatre, students will evaluate major dramatic conventions and performance methodologies.
4. **Exploring Theatre as Social Critique:** Learners will assess how European drama reflects societal concerns, including themes of fate, gender dynamics, class struggle, and political ideology.
5. **Developing Interpretative and Performative Skills:** Students will refine their analytical approaches to dramatic texts while gaining insights into staging, characterization, and audience engagement.

DS-14
ENGDSC614T
INDIAN CLASSICAL LITERATURE

Module I

Background discussion on Indian epic, themes and recension, classical Indian drama, theory and praxis, alamkara, bhava and rasa, dharma and niti
ModuleII
Banabhatta, Kadambari, trans. Padmini Rajappa
Module III
Vyasa, The Book of the Assembly Hall in Mahabharata, trans. & ed. J. A. Buitenen
Module IV
Sudraka, Mrcchakatika trans. M.M. Ramachandra Kale
Module V
Kalidasa, Abhijnanasakuntalam in The Loom of Time, trans. Chandra Rajan
The following portions are earmarked for detailed study:
Kadambari – Prologue & Chapter I (Parrot Speaks)
Mahabharata - The Book of the Assembly Hall The Dicing (Chapters 43-65)
Mrchhakatika - Acts I, V, IX & X
Abhijnanasakuntalam - Acts I, IV & VI

COURSE OUTCOMES:

1. **Understanding Classical Literary Traditions:** Students will explore Indian classical literature's thematic, stylistic, and philosophical dimensions, examining how epics, dramas, and narratives shaped early literary thought.
2. **Analyzing the Role of Rasa and Alamkara:** Learners will engage with foundational literary aesthetics, assessing how figures of speech, emotional states (bhava), and dramatic sentiment (rasa) enhance textual depth and reader engagement.
3. **Interpreting Canonical Texts:** Students will critically study *Kadambari*, *The Mahabharata*, *Mrcchakatika*, and *Abhijnanasakuntalam*, evaluating their cultural, ethical, and historical significance.
4. **Exploring Dharma, Niti, and Social Constructs:** Learners will assess how classical Indian literature reflects moral dilemmas, duty (dharma), and governance (niti), offering insights into socio-political ideologies.
5. **Tracing the Evolution of Dramatic and Narrative Forms:** Students will examine early Indian storytelling, identifying theatrical conventions, character development, and structural innovations that influenced later literary traditions.

DS-15
ENGDSC613T
POPULAR LITERATURE

Background study - Coming of age, the canonical and the popular, ethics and education in children 's literature, sense and nonsense, the graphic novel
Module I
Film Adaptations of Shakespeare
Module II
Herge -Tintin in Tibet
Module III
Lewis Carroll - Through the Looking Glass
Module IV
Agatha Christie - The Murder of Roger Ackroyd
Module V
J.K. Rowling - Harry Potter and the Philosopher's Stone

COURSE OUTCOMES:

1. **Understanding the Dynamics of Popular Fiction:** Students will examine the evolution of popular literature, exploring its relationship with canonical texts and assessing its impact on entertainment, education, and ethical discourse.
2. **Analyzing Adaptation and Genre Conventions:** Learners will evaluate the adaptation of Shakespeare's works into films, considering how cinematic storytelling transforms classic literature for modern audiences.
3. **Exploring Children's and Young Adult Literature:** Students will critically engage with *Tintin in Tibet*, *Through the Looking Glass*, and *Harry Potter and the Philosopher's Stone*, identifying themes of adventure, identity, fantasy, and moral instruction.
4. **Investigating Mystery and Narrative Structure:** Through *The Murder of Roger Ackroyd*, learners will study the conventions of detective fiction, focusing on narrative techniques, unreliable narrators, and reader engagement.
5. **Assessing the Role of Graphic and Visual Storytelling:** Students will explore the significance of graphic novels and illustrated literature, recognizing their impact on narrative accessibility, artistic expression, and contemporary literary trends.

DS-16
ENGDSC716T
POSTCOLONIAL LITERATURES

Background study—decolonization, globalization and literature; literature and identity Politics; writing for the new world; region, race and gender; postcolonial literatures and question of form

Module I: Drama

Indian History Made Easy – Badal Sircar

Module II: Novel

Gabriel Garcia Marquez-- Chronicle of a Death Foretold

Module III: Poetry

Pablo Neruda-- Tonight I can Write

Derek Walcott --A Far Cry from Africa

David Malouf --Revolving Days

Mamang Dai --Small Towns and the River

Module IV: Novel

Chinua Achebe—Things Fall Apart

Module V: Short Fiction:

Bessie Head - The Collector of Treasures

Ama Ata Aidoo - The Girl Who Can

Grace Ogot - The Green Leaves

COURSE OUTCOMES:

1. **Understanding Postcolonial Themes:** Students will explore how literature reflects decolonization, globalization, identity politics, and socio-cultural struggles across different regions and historical contexts.
2. **Analyzing Literary Representations of Race, Gender, and Region:** Learners will examine how postcolonial texts challenge dominant narratives, foregrounding perspectives shaped by colonial oppression and cultural resilience.
3. **Interpreting Poetic, Dramatic, and Fictional Forms:** Through close study of drama, poetry, novels, and short fiction, students will assess the stylistic innovations and thematic concerns that define postcolonial storytelling.
4. **Examining Historical and Political Contexts:** Students will critically engage with texts like *Things Fall Apart* and *Chronicle of a Death Foretold*, recognizing their commentary on colonial legacies, power structures, and social transformation.

5. **Developing Critical and Comparative Perspectives:** Learners will refine their analytical skills by comparing postcolonial literature from different geographies, evaluating how diverse voices articulate resistance, identity, and cultural hybridity.

DS-17
ENGDSC717T
PARTITION LITERATURE

Module I
Background Study of Partition of Bengal and Punjab, Colonialism, Nationalism, Communalism, Violence, Refugee and Exile, Women in Partition
Module II: Novel
Intizar Husain --Basti, tr. Frances W. Pritchett (New Delhi: Rupa, 1995).
Module III: Poetry
Faiz Ahmad Faiz, For Your Lanes, My Country, in In English: Faiz Ahmad
Faiz, A Renowned Urdu Poet, tr. and ed. Riz Rahim (California: Xlibris, 2008) p. 138.
Amrita Pritam, I say Unto Waris Shah Translated by Khushwant Singh
Gulzar, Toba Tek Singh, tr. Anisur Rahman, in Translating Partition, ed. Tarun Saint et. al. (New Delhi: Katha, 2001) p. x.
Module IV: Novel
Khushwant Singh—Train to Pakistan
Module V: Short Fiction
Dibyendu Palit, Alam's Own House, tr. Sarika Chaudhuri, Bengal Partition
Stories: An Unclosed Chapter, ed. Bashabi Fraser (London: Anthem Press, 2008) pp. 453–7
Manik Bandopadhyay, The Final Solution, tr. Rani Ray, Mapmaking: Partition Stories from Two Bengals, ed. Debjani Sengupta (New Delhi: Srishti, 2003) pp. 23–39.
Sa'adat Hasan Manto, Dog of Tithwal', in Black Margins: Manto, tr. M. Asaduddin (New Delhi: Katha, 2003) pp 204 – 211.
Lalithambika Antharajanam, A Leaf in the Storm, tr. K. Narayana Chandran, in Stories about the Partition of India ed. Alok Bhalla (New Delhi: Manohar, 2012) pp. 137–45.

COURSE OUTCOMES:

1. **Understanding Historical and Socio-Political Contexts:** Students will critically examine the Partition of Bengal and Punjab, exploring themes of colonialism, nationalism, communalism, and the impact of displacement on refugees and exiles.
2. **Analyzing the Literary Representation of Partition:** Learners will engage with novels, poetry, and short fiction to assess how literature portrays the trauma, violence, and human suffering associated with Partition.
3. **Exploring Gender and Marginalized Voices:** Through works by Amrita Pritam, Lalithambika Antharajanam, and others, students will examine the experiences of women in Partition narratives, highlighting themes of loss, resilience, and agency.
4. **Interpreting Symbolism and Narrative Techniques:** Students will study diverse literary styles, including allegory, satire, realism, and psychological depth, as reflected in *Basti*, *Train to Pakistan*, and Manto's short fiction.
5. **Developing Critical Perspectives on Memory and Identity:** Learners will explore how Partition literature engages with themes of historical memory, identity fragmentation, and the role of storytelling in preserving cultural narratives.

DS-18
ENGDSC818T
Research Methodology

Aim & Scope:
The aim of this course is to initiate scientific approach to research in language and literature; to introduce the students to the methods of scrupulous writing and careful documentation of research; to provide the

students information about writing processes in research. It includes the understanding and application of appropriate research design, method of report writing and presentation. The course introduces the key conceptual issues of different research methods so as to enable the students to apply these in their analyses.

Learning Objectives:
 To facilitate a concrete understanding of the methods of doing research, data collection and analysis, report writing.
 To help students to identify research gaps by reviewing the existing literatures on the concerned topic and state the research questions.
 To articulate the methodological aspects required in specific research.
Course Details:
Module I: Introduction to Research
 Meaning, Objectives, Motivation, Utility of Research
 Types and Methods of Research –Qualitative, Quantitative, Mixed
 Theory Building and Understanding the Language of Research (Concept, Construct, Definition)
 Research Ethics
Module II: Formulation of Research
 Social Research Process
 Literature Review Process and Formulation of Research Questions
 Hypothesis- Characteristics and Types
 Hypothesis Testing –Logic and Importance
Module III: Methods of Academic Writing
 How to Write a Dissertation
 Style Sheet-MLA (latest version)
 Importance of Bibliography
 Software for Reference Management and Detection of Plagiarism
 Quoting, Paraphrasing, and Avoiding Plagiarism
Module IV: Use of Resources
 What is Archive and how to use It
 Understanding and Using the Library
 Using the Internet for Research
 Computer for Data Processing
 Tabulation and Graphical Representation of Data
Module V: Practical Application
 Writing a Research Proposal or Report
 Alternative Ways to Present Research

COURSE OUTCOMES:

1. **Understanding Research Fundamentals:** Students will gain insight into the core principles of research in language and literature, including its objectives, motivations, and ethical considerations.
2. **Developing Research Formulation Skills:** Learners will be able to identify research gaps, articulate research questions, and construct hypotheses through rigorous literature review and social research methodologies.
3. **Mastering Academic Writing and Citation Practices:** Students will learn essential techniques for writing dissertations, structuring bibliographies, adhering to MLA style, and employing reference management tools to prevent plagiarism.
4. **Utilizing Research Resources and Data Analysis Tools:** Learners will engage with archival materials, library databases, online sources, and data processing software to enhance their research capabilities.
5. **Applying Research through Practical Implementation:** Students will develop the ability to write and present research proposals and reports effectively, exploring alternative methods of academic presentation.

DS-19
ENGDSC819T
Gender and Literature

Module I
Social Reform and Women 's Rights, the Confessional Mode in Writing on Gender, Sexual Politics, Race, Caste and Gender, LGBTQAI+ Studies, Masculinities
Module II: Non-fiction
Mary Wollstonecraft, A Vindication of the Rights of Woman (New York: Norton, 1988) chap. 1, pp. 11–19; chap. 2, pp. 19–38.
Rassundari Debi, excerpts from Amar Jiban in Susie Tharu & K. Lalita eds. Women 's Writing in India. Vol 1.
Module III: Poetry
Emily Dickinson - I cannot live with you
Sylvia Plath – Daddy, Lady Lazarus
Eunice De Souza - Advice to Women, Bequest
Vikram Seth – ‗Through Love 's Great Power
Module IV: Fiction
Shyam Selvadurai–Funny Boy
Module V: Short Fiction
Charlotte Perkins Gilman – The Yellow Wallpaper
Katherine Mansfield – Bliss
Ismat Chughtai – Lihaaf

COURSE OUTCOMES:

1. **Exploring Gender and Social Reform:** Students will examine historical and contemporary gender discourse, assessing the role of literature in shaping discussions on women's rights, sexual politics, and LGBTQIA+ representation.
2. **Analyzing Feminist and Confessional Writing:** Learners will critically engage with works by Wollstonecraft and Rassundari Debi, exploring autobiographical and polemical approaches to gender advocacy.
3. **Interpreting Poetic Expressions of Identity:** Through Dickinson, Plath, De Souza, and Vikram Seth, students will study themes of personal agency, societal constraints, and the intersectionality of gender and artistic expression.
4. **Engaging with Gender in Fictional Narratives:** Learners will evaluate *Funny Boy* and *The Yellow Wallpaper*, analyzing how literature reflects experiences of oppression, gender fluidity, and the challenges of identity formation.
5. **Applying Intersectional Perspectives:** Students will refine their ability to critique literature through the lenses of race, caste, and gender, recognizing how different social structures influence literary representation and discourse.

DS-20
ENGDSC820T
Literature, Science & Ecology

Module I
Non-Fiction
Selections from 4 excerpts (2 from each Group):
Group A
Charles Darwin, The Origin of Species
Michel Foucault, The Birth of the Clinic
Donna Harraway, A Cyborg Manifesto
Group B
Rachel Carson 's Silent Spring
Cheryll Glotfelty et al, ―Introduction‖ (xv-xxxvii) in The Ecocriticism Reader

Ramchandra Guha, Environmentalism and Global History.
Module II
Drama (any 1 play)
Henrik Ibsen, An Enemy of the People
Manjula Padmanabhan, Harvest
Module III
Fiction (any 1 novel)
H G Wells, The Island of Doctor Moreau
Amitav Ghosh, The Hungry Tide
Module IV
Short Stories (2, taking 1 from each Group)
Group A
Edgar Allan Poe, ―The Unparalleled Adventure of One Hans Pfaall
Issac Asimov, ―Robbie
Group B
Ruskin Bond, Our Trees Still Grow in Dehra
Mahasweta Devi, Arjun
Module V
Poetry (4 poems, 2 from each Group)
Group A
Edgar Allan Poe, Sonnet-To Science
Walt Whitman, When I Heard the Learn'd Astronomer
Emily Dickinson, A Light Exists in Spring
Rudyard Kipling, The Secret of the Machines
Group B
William Blake, London
Dylan Thomas, The sap that through the green fuse drives the flower‖
Temsula Ao, Lament for an Earth
Gieve Patel, On Killing a Tree

COURSE OUTCOMES:

1. **Understanding Intersections of Literature, Science, and Ecology:** Students will explore how scientific theories, environmental movements, and literary narratives shape cultural discourse, engaging with works from Darwin, Foucault, and Haraway.
2. **Analyzing Ecological and Environmental Themes:** Learners will study texts such as *Silent Spring* and *Environmentalism and Global History*, examining how literature responds to ecological crises and the ethics of conservation.
3. **Exploring Social and Scientific Narratives in Drama and Fiction:** Students will critically engage with plays like *An Enemy of the People* and novels like *The Island of Doctor Moreau* and *The Hungry Tide*, investigating how science, ethics, and dystopian themes interact.
4. **Interpreting the Role of Nature and Technology in Literature:** Through selected short stories and poems, learners will assess how literature critiques technological progress, industrialization, and human impact on the environment.
5. **Developing Critical Perspectives on Literary and Scientific Thought:** Students will refine their analytical approaches, considering how literature and ecological studies influence societal awareness and global environmental discussions.

DS-21
ENGDSC821T
Indian Dalit Literature in English Translation

Module I
Excerpts from autobiographies/memoirs
Omprakash Valmiki, Joothan, Excerpt.

Baby Kondipa Kamble, Jinne Amuche (Our Lives), Excerpt from Sharmila Rege, Writing Caste, Writing Gender.
Manohar Mouli Biswas, Surviving in my World, Excerpt.
Module II
Fictional prose
Arjun Dangle, Promotion , from Arjun Dangle (ed), Poisoned Bread
Kapil Krishna Thakur, The Tale of Dukhiram Mandal, tr. Debi Chatterjee from Under My Dark Skin.
Bandhumadhav, The Poisoned Bread from Arjun Dangle (ed), Poisoned Bread
Module III
Non-fiction
B R Ambedkar, Waiting for a Visa ', Sections 2 and 3.
Channanna Walikar, Whether One Loses or Wins, One Should Stand Up and fight, Even Against God, from Susie Tharu and K. Satyanarayana, Steel Nibs are
Sprouting
Anand Teltumbe, The Caste Context, from Teltumbe, Dalits.
Module IV
Novel
Bama, Karukku
Module V
Poetry
Waman Kardak, Send My Boy To School
Amar Biswas, Known-Unknown
Sudhir Mallick, The Storm
Arun Kamble, Which language should I speak?
Kalyani Thakur, Rice Slaves

COURSE OUTCOMES:

1. **Understanding Dalit Narratives and Representation:** Students will critically engage with autobiographies, memoirs, fiction, and poetry, analyzing how Dalit voices challenge caste oppression and articulate lived experiences.
2. **Exploring Social, Political, and Historical Contexts:** Learners will examine the intersections of caste, identity, and resistance through texts like *Joothan*, *Waiting for a Visa*, and *Karukku*, assessing their role in shaping Dalit consciousness.
3. **Interpreting Themes of Marginalization and Empowerment:** Through poetry and prose by Waman Kardak, Arun Kamble, Bandhumadhav, and Anand Teltumbe, students will explore themes of education, dignity, protest, and systemic inequalities.
4. **Analyzing Literary Forms and Stylistic Innovations:** Students will evaluate the unique narrative structures and stylistic choices in Dalit literature, considering how language, tone, and storytelling contribute to social critique.
5. **Developing Critical Approaches to Caste and Literature:** Learners will refine their ability to assess how literature serves as a tool for activism, memory, and identity formation, engaging with broader discussions on social justice and equality.

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
ENGHSE101M/ENGHSE303
ENGLISH LANGUAGE TEACHING (ELT)

Knowing the Learners (Theory)
i. Characteristics of a Good Language Learner
ii. Factors behind success/failure of Language learning
ii. Concepts: L1 (First Language), ESL (English as Second Language), EFL (English as

Foreign Language)
2. Teaching and Learning Basic Language skills (Practical)
i. Listening, Speaking, Reading and Writing- Basics of LSRW Skill Development
3. Approaches and Methods of English Language Teaching (Theory)
i. Grammar-Translation Method
ii. Direct Method
iii. Communicative Approach
4. Materials for Language Teaching (Theory and Practical)
i. Materials for Teaching Four language Skills (LSRW)
ii. Using the Textbook
iii. Using authentic Materials
iv. Using Teaching Aids
5. Language Evaluation (Theory):
i. Different kinds of Tests
ii. Reliability and validity of tests

COURSE OUTCOMES:

1. **Understanding Language Learning Theories:** Students will explore the characteristics of effective language learners, analyzing factors that influence success and failure in language acquisition.
2. **Developing Core Language Skills through Practical Application:** Learners will refine their listening, speaking, reading, and writing abilities by applying foundational LSRW techniques in structured learning environments.
3. **Examining Approaches to Language Teaching:** Students will engage with key teaching methodologies, including the Grammar-Translation Method, Direct Method, and Communicative Approach, assessing their pedagogical effectiveness.
4. **Utilizing Diverse Teaching Materials and Resources:** Learners will evaluate how textbooks, authentic materials, and teaching aids contribute to the enhancement of language instruction and learner engagement.
5. **Assessing Language Proficiency and Evaluation Techniques:** Students will study different types of language tests, developing an understanding of assessment reliability, validity, and their role in measuring linguistic competence.

SE-2
ENGHSE202M
ENGLISH COMMUNICATION

1. Language of Communication:

i. Types and modes of communication
ii. Personal, social and business
2. Speaking Skills
i. Dialogue
ii. Group Discussion
iii. Interview
3. Reading and Understanding
i. Comprehension
ii. Summary, Paraphrasing
4. Writing Skills
i. Writing Reports
ii. CV Writing
iii. Writing Emails

iv. Correspondence: Personal, Official & Business

COURSE OUTCOMES:

1. **Developing Effective Communication Strategies:** Students will understand different modes of communication—personal, social, and business—enhancing their ability to interact effectively in various contexts.
2. **Mastering Spoken Communication Techniques:** Learners will refine their speaking skills through dialogues, group discussions, and interviews, improving clarity, confidence, and articulation.
3. **Enhancing Reading and Analytical Abilities:** Students will engage with comprehension exercises, summarization, and paraphrasing, strengthening their ability to process and critically analyze written materials.
4. **Refining Writing Proficiency for Professional and Personal Contexts:** Learners will practice writing reports, CVs, emails, and different forms of correspondence, ensuring accuracy, structure, and formal tone.
5. **Applying Communication Skills to Real-World Scenarios:** Students will develop a practical understanding of language use in professional environments, preparing them for academic, workplace, and social interactions.

ABILITY ENHANCEMENT COURSE (AEC)

AE-1
ENGHAE101T
INDIAN WEAVES, Orient Black Swan, 2020

Tagore - Where the Mind is without Fear
Dilip Chitre - The Felling of the Banyan Tree
Premchand - Thakur ‘s Well
R. K. Narayan - The Doctor ‘s Word

COURSE OUTCOMES:

1. **Exploring Social and Cultural Themes:** Students will analyze how literature reflects societal values, colonial resistance, environmental consciousness, and human resilience through works by Tagore, Chitre, Premchand, and Narayan.
2. **Interpreting Poetic and Prose Narratives:** Learners will engage with poetic and prose texts, examining themes of hope, fear, tradition, nature, and morality in both modern and classical Indian literature.
3. **Understanding Language and Literary Style:** Students will critically assess each writer’s narrative techniques, use of imagery, and literary devices to understand how form and content interact in storytelling.
4. **Examining Historical and Philosophical Perspectives:** Through texts such as *Where the Mind is Without Fear* and *Thakur’s Well*, learners will explore themes of freedom, caste politics, and ethical dilemmas in Indian society.
5. **Developing Analytical and Reflective Reading Skills:** Students will refine their ability to interpret literature within historical and personal contexts, deepening their appreciation for diverse literary traditions.

AE-2
ENGHAE202T
GLIMPSES, Edn 2, Orient BlackSwan, 2020

William Shakespeare - All the World‘s a Stage
William Butler Yeats- Wild Swans at Coole
Anton Chekov - The Lottery Ticket
Katherine Mansfield -A Cup of Tea

COURSE OUTCOMES:

1. **Exploring Philosophical and Existential Themes:** Students will analyze Shakespeare's *All the World's a Stage*, examining its portrayal of life's stages, human destiny, and theatrical metaphors.
2. **Interpreting Poetic Reflections on Time and Nature:** Learners will engage with Yeats' *Wild Swans at Coole*, studying its themes of impermanence, beauty, and personal reflection.
3. **Understanding Psychological and Social Narratives in Fiction:** Through Chekhov's *The Lottery Ticket* and Mansfield's *A Cup of Tea*, students will explore themes of class dynamics, human expectations, and emotional introspection.
4. **Examining Literary Techniques and Stylistic Approaches:** Students will assess poetic imagery, dramatic monologue, irony, and narrative techniques, enhancing their ability to interpret literary craftsmanship.
5. **Developing Critical and Comparative Analytical Skills:** Learners will refine their ability to evaluate literature across different genres, recognizing universal themes and unique cultural perspectives.

AE-3
ENGHAE303T
VERBAL ABILITY (50 MARKS)

1. Vocabulary: Synonyms, Antonyms, Homonyms, Technical Terms - 10 marks
2. Articles & Prepositions - 10 marks
3. Phrasal verbs & Idioms - 10 marks
4. Transformation of Sentences – 10 marks
5. Common Errors– 10 marks

Students' Companion, Wilfred D. Best, Longman
Remedial English Grammar for Foreign Students, F.T. Wood, Trinity

COURSE OUTCOMES:

1. **Enhancing Vocabulary and Language Precision:** Students will develop a stronger grasp of synonyms, antonyms, homonyms, and technical terms, improving their ability to use precise and contextually appropriate language.
2. **Mastering Grammar and Sentence Structure:** Learners will refine their understanding of articles, prepositions, phrasal verbs, and idioms, strengthening their ability to construct grammatically sound sentences.
3. **Applying Transformational Grammar Techniques:** Students will engage with sentence transformation exercises, enhancing their ability to modify sentence structures while maintaining clarity and meaning.
4. **Identifying and Correcting Common Errors:** Through rigorous practice, learners will develop the skills to recognize and rectify common grammatical mistakes, ensuring accuracy and fluency in writing and communication.
5. **Utilizing Reference Materials for Language Improvement:** Students will effectively engage with resources like *Students' Companion* by Wilfred D. Best and *Remedial English Grammar* by F.T. Wood, utilizing structured learning strategies to refine their linguistic proficiency.

For UG NEP2020 syllabus of English in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2024/02/English-NEP-Syllabus.pdf

Program and Course Learning outcome of Undergraduate course

Department of Geography
BIDHANNAGAR COLLEGE
SALT LAKE

INTRODUCTION

The B.Sc. Major in Geography under West Bengal State University's NEP-2020 syllabus is a four-year honours programme that equips students with a robust interdisciplinary foundation, combining physical, human, and applied geographical sciences. In the initial semesters, learners engage with core papers such as **Fundamentals of Geography**, **Evolution of the Earth system**, and **Geography of India and West Bengal**, laying the groundwork in geomorphology, climatology, biogeography, and regional studies. As the course advances, specialized major papers delve into **Population & Settlement Geography**, **Economic Geography**, **Environmental Geography**, **Oceanography**, and **Regional Planning**, alongside crucial practical training in statistical techniques, fieldwork, remote sensing, GIS, and contemporary issues in geography. Emphasizing blended learning, the curriculum integrates theoretical lectures with hands-on components—lab sessions, field excursions, map-analysis, and project reports—to foster analytical thinking, spatial data handling, and technical proficiency. Skill enhancement and elective modules under NEP allow students to tailor their academic journey while cultivating transversal skills essential for public policy, environmental planning, urban development, disaster management, and geospatial industries. On completion, graduates emerge with a holistic understanding of Earth systems, human–environment interactions, and spatial methodologies, well-prepared for roles in government, academia, research, GIS consultancy, and advanced studies, all aligned with the NEP's goal of multidisciplinary competence and experiential learning.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

Programme Outcomes	
PO-1	**Understanding of basic Concepts:** The fundamentals of how humans interact with nature, as well as sophisticated spatial analysis and technology (such as GIS and remote sensing), conservation and resource management, climate change analysis, urban and regional planning.
PO-2	**Understanding of physical & Cultural landscape:** In geography understanding both physical and cultural landscapes is crucial for comprehending how humans interact with their environment and the resulting features of the Earth's surface.
PO-3	**Application of geography:** Lear aquired knowledge for numerous practical application in daily life and various professions.
PO-4	**Future scope of geography:** The program offers a broad range of future career prospects, particularly in fields related to environmental science, urban planning, GIS(Geographic information systems), and research.

Programme Specific Outcomes	
PSO-1	**Development of Knowledge:** Students will develop a proficiency of knowledge of the fundamental principles of both Physical and Human Geography. This will give a holistic knowledge of the global environment.
PSO-2	**Skill Development:** The application of cartographic techniques and statistical methods enable the students to acquire the skill of presenting and interpreting the subject in a scientific and logical manner that is more understandable to other disciplines and other fields.
PSO-3	**Deal with Current Geographical Issues and their Solutions:** Students will learn to solve issues include climate change, pollution, deforestation, biodiversity loss, and resource scarcity.
PSO-4	**Gain knowledge about modern scientific methods:** The student is exposed to modern scientific knowledge and its applications through GIS, remote sensing, field work
PSO-5	**Gain Knowledge about Population Geography, and solve various Problems:** The students will learn to calculate Human Development Index and Gender Development Index. They are thus made eligible for their contribution in Population Policies and Census Data Collection and Analysis.
PSO-6	**The Role of Geography Students in Population Projections:** By studying geography, students will be able to explain about the solution to problem related to population control.
PSO-7	**Geography's discussion of the relationship between the environment and humans:** The students will understanding dynamic interactions between human and environment and address issues like climate change and resource management.
PSO-8	**Employment and Progression:** The students graduating with Geography are eligible enough to pursue further studies which refers to Post-graduate course, PhD, B.ED, GIS studies, Rural Studies, Urban Management, and Environmental Management.
PSO-9	**Geography as a field of application of knowledge:** The students are trained to apply their holistic knowledge to various fields.
PSO-10	**Linkages with related disciplines:** Integrate concept from multidisciplinary subject to enhance their understanding and application
PSO-11	**Communicative Skill:** Develop communicative skills and human values

PO-CO Mapping

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9	PSO-10	PSO-11
DS-1	Y	Y	Y	Y			Y	Y	Y		
DS-2	Y	Y	Y	Y	Y	Y	Y	Y	Y		
DS-3	Y	Y	Y	Y			Y	Y	Y		
DS-4	Y	Y	Y	Y			Y	Y	Y		
DS-5	Y		Y	Y	Y	Y		Y	Y		
DS-6	Y		Y		Y	Y	Y	Y	Y		
DS-7	Y	Y		Y	Y	Y		Y	Y		
DS-8	Y		Y	Y	Y	Y	Y	Y	Y		
DS-9	Y		Y	Y	Y		Y	Y	Y		
DS-10	Y		Y	Y			Y	Y	Y		
DS-11	Y	Y	Y	Y	Y		Y	Y	Y		
DS-12	Y								Y		
DS-13	Y	Y	Y	Y			Y	Y	Y		
DS-14	Y		Y		Y	Y		Y	Y		
DS-15	Y	Y	Y	Y	Y	Y	Y	Y	Y		
DS-16	Y		Y	Y			Y	Y	Y		
DS-17	Y	Y	Y	Y		Y	Y	Y	Y		
DS-18	Y	Y	Y	Y	Y			Y	Y		
DS-19	Y	Y	Y	Y	Y	Y	Y	Y	Y		
DS-20	Y	Y	Y	Y			Y	Y	Y		
DS-21	Y		Y	Y	Y	Y	Y	Y	Y		
MA-1/MB-1										Y	
MA-2/MB-2										Y	
MA-3/MB-3										Y	
SM-1/SM-2										Y	
SE-1	Y	Y	Y	Y	Y		Y	Y	Y		
SE-2	Y	Y	Y	Y	Y	Y	Y	Y	Y		
SE-3										Y	
MD-1/MD-2/MD-3										Y	
AE-1											Y
AE-2											Y
AE-3											Y
VA-1											Y
VA-2											Y

COURSE LEARNING OUTCOMES

GEOGRAPHY MAJOR COURSES (DSC-Discipline Specific Course)

DS-1
GEOADS01T/ GEOADS01P
(PHYSICAL GEOGRAPPHY)
(Credit:5, Theory-3, Practical-2)

- This course fosters the fundamental idea of geotectonics by studying the earth's interior structure and the main factors that shape its surface level.
- By studying landform regulating variables, the effect of lithology, and other agents of exogenetic forces, this course provides an understanding of physical geography and aids in understanding the fundamental principles of geomorphology.
- The pupils learn the main strategies of important activities and get an awareness of the potential threat of a hazard or disaster.
- This course assesses the concepts of biogeography and climatology, helps students comprehend the fundamentals of ecosystems and the concept of different biomes, and teaches them about the formation of the atmosphere, the distribution of the planetary wind system, soil formation, and its governing factors.

In practical, the students will learn

- The subject of "Linear Scale" aids in the student's understanding of scales and the development of finer measurement skills.
- The notion of displaying appropriate cartographic approach employing various height points from topographical maps is highlighted by the topic "Altimetric Frequency Distribution."
- Students can better grasp the fundamentals of topographical maps by identifying drainage patterns, geomorphic features, settlement patterns, and networks of channels and transportation.
- The "Broad Physiographic Zones" sketch provides a concise explanation of the landscape's creation, regional fluvial processes, vegetational influence, and change rather than height.
- By creating a "Wind Rose Diagram," students may learn about the fundamentals of wind systems and gain an understanding of a location's yearly wind direction and speed.

Broad Content of course

- Internal Structure of Earth
- Influence of lithology and factor controlling landforms development
- Evolution of landforms
- Nature and classification of hazard
- Brief encounter of atmosphere and concept of wind system
- Formation and factor of soil
- Concept ecosystem and biomes

DS-2
GEOADS02T/GEOADS02P
(HUMAN GEOGRAPPHY)

(Credit:5, Theory-3, Practical-2)

- This paper helps students understand the societal process, ethnic diversity, and development of various regions by covering topics such as political system, resource management, environmental location and landscape, recent trends, locational aspect, pastoral nomadism, industrial evolution, subsistence farming, and other things.
- This course gives students a foundational understanding of population density, distribution, and growth rate in addition to demographic transition theory

- This unit aids students in understanding the evolution of human societies and human adaptation and adjustment to nature.
- This course aids students in understanding the settlement distribution, planning, and patterns of urban and rural societies and their classification in India.

In practical, the students will learn

- Students gain the ability to recognize and compute various patterns of growth rate in a given area.
- Assist students in mastering the statistical thematic mapping method so they can recognize different density patterns in any location.
- This article teaches students a variety of statistical cartography approaches that are used to analyze spatial data in diverse geographic phenomena.
- Students can better comprehend community structure, development planning, and cultural attributes by drawing and interpreting geological maps.

Broad Content of course

- Elements and Approaches in human geography
- Evolution of human societies and their adaption to environment
- World population
- Demographic Transition Theory
- Classification of Economic Sectors
- Types of Agriculture
- Urban and Rural settlement

DS-3

GEOADS03T/GEOADS03P

(Geotectonics and Geomorphology)

(Credit:5, Theory-3, Practical-2)

- This course fosters the fundamental ideas of geomorphology and geotectonics, including the study of how isostasy preserves gravitational equilibrium as tectonic processes modify the Earth's crust to create landforms like mountains and ocean basins.
- The students gain knowledge of plate tectonics, which is the process by which the plates of Earth's lithosphere move across the asthenosphere due to mantle convection, producing geological features such as faults and folds.
- his course demonstrates how geological features and river movement interact to build the Earth's surface through degradational processes including weathering, mass wasting, and erosion that reduce elevations and move materials.
- Students are able to comprehend While glacial and glacio-fluvial processes use sediment transport and deposition to disclose climatic history, coastal processes use wind, tides, and waves to form coasts.
- Research aids pupils in comprehending In dry areas, wind affects aeolian processes, leading to erosion and sediment movement. Geomorphologists study the landforms created by fluvio-aeolian interactions, such as alluvial fans.

In practical, the students will learn

- In order to help students comprehend the concept of minerals, megascopic identification entails analyzing rocks and minerals with the unaided eye or hand lens to determine their composition, physical characteristics, formation environment, and possible applications.
- Geological maps provide for a thorough reconstruction of the geological history of a region by displaying unconformities, folds, intrusions, and uniclinal structures.
- Students gain the ability to analyze and comprehend SOI Topographical Maps, which enables them to recognize a variety of cultural and physical characteristics and investigate their relationships.

- Students may learn about rock stratigraphy, geological time scale, and the link between topography and underlying layers by creating and analyzing geological maps.

Broad Content of course

- Basic ideas of Geomorphology
- The constitution of Earth's interior
- Geomorphic Processes
- Evolution of Landforms

DS-4
GEOADS04T/ GEOADS04P
(CLIMATOLOGY)
(Credit:5, Theory-3, Practical-2)

- This essay will provide a general overview of the atmosphere and the different atmospheric processes that determine the average climate and everyday weather.
- Students will comprehend the mechanisms behind the planet's heat balance, the greenhouse effect, global warming, and the variables that contribute to latitudinal temperature variance.
- Students will also be able to comprehend the concepts of high and low pressure, wind circulation, monsoon origin, tropical and temperate cyclones, and the regions where they originate and are impacted.
- Students will comprehend the mechanisms underlying rainfall in tropical and temperate regions, as well as the many types of precipitation.

In practical, the students will learn

- Students may easily comprehend India's pre-, monsoon, and post-monsoon weather maps during various seasons using this. allows for forecasting, planning, and effect assessment by providing insightful information on the nation's climate.
- Hythergraphs and climographs are graphical tools used in climatology and geography to examine the relationship between important climatic variables, mainly temperature and precipitation, over a certain place over the course of a year. This course helps students comprehend these concepts.
- Students may gain an understanding of the monthly rainfall dispersion diagram from this paper. This powerful statistical visualization tool is often created using the quartile approach, which produces a box-and-whisker plot. It shows how rainfall varies and is distributed across several years at a particular place for a certain month.

Broad Content of course

- Composition and structure of the atmosphere
- Heat budget of the earth; Latitudinal and seasonal variation of Insolation; Distribution of temperature, Inversion of Temperature, Greenhouse gases and global warming
- Types of fonts
- Air mass
- Weather formation
- Atmospheric disturbance
- Mechanism of monsoon
- Koppen's and Thornthwaite's scheme of classification

DS-5
GEOADS05T
(ECONOMIC GEOGRAPHY)
(Credit:5)

- Students can study the geographical organization of economic activities, such as the production, trade, consumption, and exchange of commodities and services, through economic geography. Despite the traditional "Economic Man" paradigm, it offers a thorough understanding of economic decisions by including ideas such as behavioral economics, institutional choice, satisficing, and rational choice.
- Students can comprehend where economic activity settles are determined by economic distance, which is basically transportation expenses. As demonstrated by Weber's model for industry and Von Thünen's model for agriculture, which both place an emphasis on cost minimization for ideal location, this influences market pricing and trade.
- This essay highlights the significance of mining and farming tasks performed by "red-collar workers" in developing nations, aiming to maximize revenues while minimizing expenses. It uses Von Thünen's Model and Weber's Model to explain this, focusing on market-driven agriculture placement and industrial placement to reduce production and transport costs, considering factors like raw material availability and market proximity.
- Economic globalization is covered in this course, along with the ways that commerce, money, technology, and information are connecting economies throughout the world. With the goal of creating a stable global system, the WTO promotes and controls international commerce. Economic blocs like BRICS have arisen after World War II, increasing the global prominence of developing economies and posing challenges to established government.

Broad Content of course

- Meaning, approach, and concept of human geography
- Economic distance and location of economic activity
- Primary, secondary, and tertiary activities
- Economic globalisation

DS-6
GEOADS06T
(GEOGRAPHY OF INDIA AND WEST BENGAL)
(Credit:5)

- This course teaches students about the distinctive tectonic provinces of India, such as the Peninsular Plateau, Himalayas, and Indo-Gangetic Plain, which were created when the Indian Plate collided with Eurasia. India's many monsoon-influenced climates, soil types, and plant zones are a result of its geological variety
- This course opens into India's agricultural sector, which was transformed by the Green Revolution (Phases I and II), which led to environmental issues and inequity while simultaneously increasing food grain output for self-sufficiency. India's abundant supplies of coal, oil, natural gas, and iron ore are vital to its industry and energy. Additionally, India's rapidly expanding IT sector and strong automotive sector both significantly contribute to the industrial growth of the nation.
- Students can understand the daily struggles faced by various Indian triable races as well as the physiographic and economic regionalization of India.
- Students learn about the characteristics of West Bengal, including its many physiographic divisions, forests, and an abundance of water resources. Strong agriculture, substantial mining (coal, iron ore), and expanding industrial development—particularly in the automotive and IT sectors—are the main drivers of its economy.

- Students learn that West Bengal's human development indexes are impacted by the population's uneven growth and distribution. The state also has to deal with particular regional problems like the Sundarbans (environmental fragility, consequences of climate change, livelihoods) and the Darjeeling Hills (socio-political difficulties, identity, resource management).
- Students in this course discover that West Bengal's population is growing unevenly, with the plains and cities seeing denser populations. This leads to human development discrepancies that benefit urban regions. While the Sundarbans are in grave danger from storms and rising seas, the Darjeeling Hills are subject to aspirations for autonomy and environmental risks to tea. Targeted sustainable development is desperately needed in both areas.

Broad Content of course

- Geomorphic features of India
- Resource management
- Tribes of India
- Industrial development
- Regionalisation of India
- Physical and cultural resource of west Bengal
- Recent regional issues

DS-7
GEOADS07T/ GEOADS07P
(CARTOGRAPHIC TECHNIQUES AND THEMATIC MAPPING)
(Credit:5, Theory-3, Practical-2)

- Together, these fundamental mathematical tools—logarithms (and anti-logarithms), rounding, scientific notation, and log scales—allow pupils to visualize a wide range of data, handle very big or tiny numbers more easily, and comprehend complicated numerical connections more successfully.
- This article teaches students that maps are categorized according to their kind and function, and that their key elements—such as scale, legend, and north arrow—are vital for correct interpretation.
- Vernier, diagonal, and comparative scales are specialized graphical scales used in engineering and drawing to measure and display lengths with increasing accuracy, allowing for accurate readings or unit comparisons, as the text explains to the students.
- The article tells the students that there are two techniques to find a point in coordinate systems: polar utilizes (r,θ), which represents distance from an origin and an angle, while rectangular employs (x,y) distances along perpendicular axes.
- This essay aids pupils in While wider map projections are categorized according to their qualities and applications to methodically turn the 3D Earth into 2D, each with inherent distortions, UTM projection, which properly flattens particular Earth zones, requires an understanding of globe production.
- Students are given an explanation in the course where data is successfully visualized using maps: dot, sphere, proportionate circle, and choropleth maps depict spatial changes, while line, bar, and isopleth maps display trends. Socioeconomic maps and land use/cover maps are essential for comprehending economic, demographic, human, and environmental trends.

In practical, the students will learn

- Students may learn about the many kinds of scales and hone their finer measurement skills by studying the topic of "Scale." They can interpret maps as a result.
- The drawing of graticules, which aids in understanding the cardinal placements of places and the conversion of 3-D spheres to 2-D planes, is the subject of the projection theme.
- Using various statistical data, the students learn how to properly depict them using cartographic approaches.

- To emphasize certain data patterns, the student learns how the creation of thematic maps uses specialist visualizations such as Age-Sex Pyramids to illustrate population structure, Dots and Sphere diagrams for rural and urban distribution, and Flow Charts to illustrate processes or movement.

Broad Content of course

- Scientific notation, concepts of rounding, logarithm and anti-logarithm, natural and log scales
- Classification, types and components of a map
- Comparative, diagonal and vernier scale
- Polar and rectangular coordinate systems
- Concept of generating globe and UTM projection
- Classification, properties, and uses of map projections
- Representation of Line, Bar, Isopleths, Dots & spheres, and proportional circles & Choropleth
- Preparation and interpretation of land use landcover and socio-economic maps

DS-8
GEOADS08T
(POPULATION GEOGRAPHTY)
(Credit:5)

- This course uses census and key data to explore population's spatial characteristics: growth, migration, composition, and distribution. We'll cover data reliability and mapping challenges. Key policy-relevant topics include urbanization, aging, migration, and the population-environment relationship.
- This course explores population geography's distribution, density, and growth, driven by migration, births, and deaths. We'll compare classical (resource limits) and modern (economic well-being) theories, tracing population shifts via the DTM, with India as a key example.
- Global population is unevenly distributed by physical (climate, land, resources) and human (development, urban, politics) factors. Growth stems from births, deaths, and migration. Optimum Population defines an ideal size for maximum quality of life, a dynamic sustainable development goal.
- This course covers population composition (age, sex, rural/urban, literacy/education) and measuring fertility/mortality, introducing concepts like cohorts and life tables.
- This course details population composition (age, sex, rural/urban, literacy, education), fertility/mortality measurement (cohorts, life tables), and specifically examines India's urbanization, occupational structure, and migration patterns.
- This course details population composition (age, sex, rural/urban, literacy, education) and fertility/mortality measurement (cohorts, life tables). It specifically examines India's urbanization, occupational structure, and migration patterns (national/international causes and types).
- This section covers population-development links (declining sex ratios, HDI), examines population policies in developed/developing nations (including India's), and analyzes population-environment interactions with future implications.

Broad Content of course

- Population development dynamics
- Population distribution, density, growth, and model building
- Concepts of fertility, mortality, and age-sex composition
- Population development and policies
- Population composition

DS-9
GEOADS09T/ GEOADS09P
(ENVIRONMENT GEOGRAPHY)
(Credit:5, Theory-3, Practical-2)

- Geographers view the world through spatial human-environment interactions, recognizing mutual shaping across scales. This aligns with a holistic systems approach, where interconnected environmental components mean changes in one part affect the whole, demanding an integrated perspective.
- This course defines an ecosystem by its interacting living and non-living parts, focusing on biotic/abiotic structure, energy flow, and nutrient cycling. You'll learn about vital ecosystem services (provisioning, cultural, supporting, regulating benefits). We'll also examine wetland ecosystems, specifically using the East Kolkata Wetlands as a case study to understand their unique structure, functions, and services.
- In this course, students will acquire information. The environmental concerns covered in this section are specific to three different contexts: urban areas, where the emphasis is on complex waste management issues; rural areas, where the emphasis is on sanitation and public health issues; and maritime habitats, where the pervasive threat of plastic pollution is emphasized.
- In this part, students will learn about worldwide Earth Summits (Stockholm, Rio, Johannesburg) and environmental policies, such as India's National Environmental Policy (2006) and NAPCC. Major international environmental initiatives including the Paris Agreement, Kyoto Protocol, and Montreal Protocol are also included.

Broad Content of course

- Approach in environmental concepts and systematic studies
- Ecosystem concepts, structures, functions, and services
- Environmental issues
- Environmental policies and global management

DS-10
GEOADS10T
(SOIL AND BIOGEOGRAPHY)
(Credit:5)

- Students will learn that understanding soil properties is crucial. This includes texture (water handling, aeration), structure (water/root movement), and moisture (plant growth). Key chemical properties covered are pH (nutrient availability), organic matter (water retention, nutrients), and NPK (essential plant macronutrients).
- Soil profiles reveal soil types. Lateritic soils (hot, humid) are reddish, nutrient-poor, and harden. Podsol soils (cool, moist, acidic) have a bleached upper layer and darker accumulation layer. Chernozem soils (temperate grasslands) are exceptionally fertile with a thick, dark topsoil.
- With a focus on people as the primary agents of soil change, this course examines the origins, mechanisms, and management of soil erosion and degradation. Additionally, it presents the idea of land capacity categorization for sustainable land use, as well as soil classification ideas, such as genetic and USDA systems.
- From the global biosphere to ecosystems and biomes, this part examines ecological organization in front of the learner. It covers ideas such as ecotones, communities, niches, succession, and ecology. After that, it explores how energy flows across ecosystems, going into detail on trophic structure, food chains, and food webs.
- The biogeochemical cycles (with a focus on carbon and nitrogen, as well as human impacts), the geographic range and features of the main biomes of the world (Tropical Rainforest, Savanna, Hot

Desert, and Taiga), and the spatial distribution of the world's fauna, with an emphasis on influencing factors, are all examined in front of the student in this section.

- In order to comprehend the distribution and diversity of plants worldwide, this course teaches students about phytogeographical areas and plant taxonomy (species, genera, and families). The origins, effects, and management of deforestation are next examined, emphasizing the main effects and preventative measures.

Broad Content of course

- Definition and significance of soil properties
- Soil profile, formation and basic principles of classification
- Concepts of biosphere, ecosystem, biome, ecotone, community, niche, succession, ecology, trophic structure, food chain & food web and energy flow in ecosystems
- biomes & phytogeographical regions
- Spatial distribution of world fauna & Causes, consequences, and management of deforestation

DS-11

GEOADS11T/ GEOADS11P

(REMOTE SENSING, GIS AND GNSS)

(Credit:5, Theory-3, Practical-2)

- The importance of remote sensing (RS), a vital ex-situ technique for gathering geographical data utilizing satellite sensors, for spatial science will be taught to the students. Environmental management, monitoring, and spatial mapping will be radically transformed by its advantages, which include extensive coverage, quantitative and multispectral data, recurrent collecting, and access to remote locations.
- The theoretical underpinnings of remote sensing (RS) will be taught to students, including how sensors (passive and active) gather data, the significance of resolutions (spatial, spectral, temporal, and radiometric), and the roles of different sensor types. The various uses of RS data in fields like environmental monitoring, urban planning, and agriculture are also covered in the course.
- Students discover that there are three main ways that Remote Sensing (RS) data is gathered: satellite-based RS for repetitive, global, large-scale monitoring; aerial RS (drones/aircraft) for detailed, high-resolution, on-demand local mapping; and ground-based RS for extremely accurate, localized data that is essential for validation. When combined, they offer complete remote sensing capabilities.
- Using tools like the Prismatic Compass and Dumpy Level, which are used to measure bearings and prepare contour drawings, students learn a variety of surveying and leveling procedures.

In practical the students will learn,

- Students can get knowledge from this course. Maps or photos are carefully aligned with actual geographic locations using georeferencing. For precise mapping, spatial analysis, and change detection, this procedure is essential for incorporating non-spatial data into a GIS.
- This course teaches students image enhancement techniques, including False Color Composite (FCC) preparation and using diverse satellite band combinations (IRS L3/Landsat OLI data). The aim is to enhance clarity, highlight/differentiate features, and optimize images for various analyses like vegetation or urban mapping.
- Students can get knowledge from this course. Computers are trained to classify satellite image pixels into different forms of land cover using supervised image classification. While post-classification analysis evaluates accuracy and derives insights such as change detection or area statistics, class editing refines these results.
- For efficient spatial data representation and understanding, this course teaches students how to digitize features, attach data, and perform overlay analysis. It also teaches them how to generate and annotate thematic maps (choropleth, pie, and bar graphs).

- Students can get knowledge from this course. Acquiring and integrating exact real-world point locations for field data gathering, mapping, and adding accurate ground-truthed spatial information to GIS projects is made possible by learning how to collect waypoints using GNSS receivers and export them to a GIS database.

Broad Content of course

- Principles of Remote Sensing
- Sensor resolutions and their applications
- Image referencing schemes and acquisition procedure of free geospatial data
- Preparation of False Colour Composites
- Principles of image interpretation and preparation of inventories
- Acquisition and utilisation of free Digital Elevation Model data
- Concept of GIS
- Principles of preparing attribute tables, data manipulation, and overlay analysis
- Principles and significance of buffer preparation
- GNSS positioning, waypoint collection, transferring and area-length calculations from GNSS data

DS-12
GEOADS12T
(EVOLUTION OF GEOGRAPHICAL THOUGHT)
(Credit:5)

- Students may discover in this course material how the Chinese created intricate mapping while the Ancient Greeks, including Eratosthenes and Ptolemy, established scientific geography. Arab scholars like Al-Idrisi and Ibn Battuta retained and enhanced this knowledge throughout Europe's "Dark Age," producing sophisticated maps and in-depth travelogues.
- Students may understand how modern geography had its start in Germany in the 19th century thanks to individuals like Ritter and Humboldt in this course material. Possibilism followed in France, geopolitics in Britain, and cultural landscape studies and a subsequent quantitative revolution in the US.
- The growth of geography from the Age of Discovery (15th–18th C.), which was fueled by explorers like Cook and Columbus who expanded global knowledge and empirical mapping, may be learned by students in this course material. For a methodical comprehension of space, this gave rise to Scientific Geography (Varenius, Kant). Core dualisms, such as human vs physical, surfaced. The scientific, analytical orientation of geography was further solidified after World War II by the Quantitative Revolution and the Systems Approach.
- This essay aids students in comprehending the beginnings and development of geography as a spatial discipline.
- The philosophical underpinnings of geography, such as positivism, pragmatism, regional and systematic approaches, determinism and possibilism, quantitative revolution, and radıcalısm, are also the main topics of this essay.

Broad Content of course

- Origin and evolution of Geographical Thinking
- Debates: - Ideographic vs. Nomothetic, Physical vs. Human, Regional vs. Systematic, Determinism vs. Possibilism
- Contributions of Greek, Chinese, Arab geographers and Humboldt and Ritter, Richthofen, Hettner, Ratzel and Vidal deLaBlaché
- Evolution of Critical Geography: Behavioural, humanistic, and radical
- Changing concept of time-space in geography in the 21st Century

DS-13
GEOADS13T/ GEOADS13P
(HAZARD MANAGEMENT)
(Credit:5, Theory-3, Practical-2)

- This paper aids students in understanding major natural catastrophes that inflict a lot of damage and displacement include floods, landslides, earthquakes, tropical cyclones, and erosion of riverbanks. Floods in floodplains, landslides destroy slopes, tropical cyclones create coastal damage, riverbank erosion results in land loss and displacement, earthquakes cause collapse, tsunamis, and fatalities close to fault zones.
- This course aids students in understanding Regardless of their origin or kind, hazards turn into catastrophes when they overwhelm populations that are already at risk. Understanding risk perception and vulnerability assessment while concentrating on social or physical events is part of studying hazards. Mitigation, acute trauma management, and long-term resilience development are all examples of effective solutions.
- This course aids students in becoming more ata (such as population, geography, and historical events) and geospatial methods (such as GIS, remote sensing, and GPS) are used in hazards mapping to geographically identify, display, and assess regions that are vulnerable to certain hazards and their possible effects. This aids in risk mitigation, planning, and evaluation.
- In this course, students may learn how to the biological risks known as biohazards are categorized according to risk (BSL 1-4), with exposure and host-based susceptibility. They may result in disease epidemics, economic harm, and other issues. Outbreaks and deaths are among the implications of management's concentration on containment, personal protective equipment (PPE), cleanliness, and public health. Public health, hygiene, and monitoring are the main concerns of management.

In the practical the students will learn,

- Students' situational awareness and reaction skills can be greatly enhanced by learning about communication technology, real-time monitoring, and hazard mapping.
- Students are able to learn Recovery is accelerated and post-disaster pandemonium is decreased by safeguarding vital services (communication, power, and water) and making sure structures can endure anticipated risks.
- Students are able to learn Effective preparedness and prompt reaction depend on empowering and educating local populations, incorporating them in planning, and utilizing their expertise (e.g., local radio for alerts).
- Students are able to learn Governmental organizations, non-governmental organizations, the commercial sector, and communities must work together harmoniously to manage disasters effectively. Silos result in inefficiencies and more pain.
- Students can discover how people's actions, perceptions of danger, and mental health affect results both during and after a crisis. These need to be addressed by management.

Broad Content of course

- Classification, approach and response in hazard’s studies
- Factors, vulnerability, consequences and management of earthquake, landslide, tropical cyclone, flood and riverbank erosion
- Hazards mapping: Data and geospatial techniques
- Biohazard: Classification, vulnerability, consequences, and management

DS-14
GEOADS14T
(SOCIAL GEOGRAPHY)
(Credit:5)

- Students learn about social geography in this subject, which maps social patterns, disparities, and identities by examining how society and place interact. By examining social differentiation (group differences) and stratification (hierarchical ranking), as well as the social processes that influence geographical arrangements, it sees space as socially produced.
- The impact of social characteristics such as caste, gender, race, religion, and class on geographical patterns in India is examined in this course. It draws attention to the ways that religion shapes distinct groups, class divides the economy, and caste frequently results in residential segregation. The course also emphasizes how shared culture and history were institutionalized via previous migrations and linguistic state reorganization following independence.
- This course examines how India's varied population has greatly impacted modern environmental challenges including pollution and climate change. The population has been altered by migratory waves and technological breakthroughs. These migrant waves have produced complicated social groupings and behaviors that have an impact on this diversified population, disproportionately affecting disadvantaged areas.
- This course looks at social well-being, which emphasizes fairness and dignity and is a measure of a society's general quality of life. Gender is important because, especially in India, inequalities in healthcare, education, and housing severely impair the wellbeing of women and other underprivileged genders.
- This lesson is presented to the learner. India's social geography is characterized by both inclusion and exclusion, as seen by the sharp difference between gated communities and slums, which are frequently connected to criminal activity and intercommunal strife. In the past, social planning in Five Year Plans sought to overcome these inequities by implementing social policies related to health and education. These days, assessing proposed projects to make sure they support fair social outcomes requires the use of Social Impact Assessments (SIA).

Broad Content of course
- Social Geography: Concept, Origin, Nature, Scope, f Space, Social differentiation & stratification and social processes
- Basic social geographical structed in India
- Concept and measures of Social Well-being
- Social policies, pattern planning and assenment

DS-15
GEOADS15P
(SOCIAL GEOGRAPHY)
(Credit:5)

In this practical based course the students will learn,
- In both open and closed traverses, students may learn how to take bearing measurements using a Prismatic Compass. Importantly, we know how to use Bowditch correction, which proportionately corrects for accuracy, to identify and fix closure mistakes in closed traverses. This teaches us the fundamentals of field surveying, how to analyze data for mapping, and the limits of compass surveying.
- Through profile surveys for linear pathways and radial contouring for area mapping, students may learn how to use a Dumpy Level to identify and portray terrain elevations. To produce precise

topographic maps for a range of uses, we develop our data processing, interpolation, and plotting abilities.

- Students learn how to use fundamental trigonometric concepts for reconnaissance-level surveys to rapidly estimate slopes and approximate elevation changes along a line from an Abney Level profile survey.
- Students demonstrate advanced surveying problem-solving skills by using a Transit Theodolite to acquire exact angle measurement and applying trigonometry to answer for object heights, even in difficult situations when the base is unreachable.

Broad Content of course

- Open and closed traverse survey using Prismatic Compass; Bowditch correction for closing error adjustment
- Profile line survey and Radial Contouring using a Dumpy Level; Plotting radial contouring data
- Profile survey using Abney level
- Determination of heights of objects with accessible and inaccessible base by Transit Theodolite (instrument and object not in same vertical plane method)

DS-16

GEOADS16T

(HYDROLOGY AND OCEANOGRAPHY)

(Credit:5)

- Through these papers, students get an appreciation for the vital physical and ecological responsibilities that water flow plays as part of a worldwide, linked system known as the hydrological cycle. Additionally, we learn more about the runoff cycle, including its governing elements and the vital processes of evapotranspiration and infiltration that control water flow and distribution.
- Students get an understanding of the drainage basin as the primary hydrological unit for water management from these papers. We are aware of the fundamentals of watershed management and water harvesting for resource sustainability. Additionally, we get thorough understanding of subterranean water, including the many kinds of aquifers, the occurrence and storage of groundwater, and the ways in which Darcy's Law and other regulating variables affect its flow, recharge, discharge, and movement.
- Students gain knowledge of the main relief features of the ocean bottom from these papers, comprehending their origins and characteristics within the framework of plate tectonics. We also learn more about the basic physical and chemical characteristics of ocean water and how they affect marine ecosystems and ocean activities.
- The interdependence of air and sea in shaping the world's climate and weather, the dynamics of ocean circulation, waves, and tides, and the kinds, causes, and effects of sea level change are all covered in these papers.
- Through these papers, students gain knowledge of the main relief features seen on the ocean floor, including their origins and characteristics due to plate tectonics. Additionally, we acquire thorough understanding of the physical and chemical characteristics of ocean water, with an emphasis on the distribution and drivers of ocean salinity and temperature, as well as how these elements affect marine life and activities.
- Based on these papers, students T-S diagrams teach us how to recognize and track water masses based on their distinct temperature-salinity properties, which aids in our comprehension of ocean stratification and deep ocean circulation.

Broad Content of course

- Systems approach in hydrology
- Controlling factors, infiltration and evapotranspiration of run off cycle

- Drainage basin and principles of water harvesting and watershed management
- Types of subsurface water, aquifers
- Groundwater and Darcy's Law
- Ocean Floor Topography and Oceanic Movements
- Ocean Resources

DS-17
GEOADS17T/ GEOADS17P
(STATISTICAL METHODS IN GEOGRAPHY)
(Credit:5, Theory-3, Practical-2)

- These papers teach students how to distinguish between continuous and discrete data kinds, comprehend population vs sample data, identify measurement scales, and become proficient in data collecting and statistical table creation.
- Students get an understanding of theoretical distributions (frequency, normal, and probability) for data analysis as well as the necessity and techniques of random sampling for trustworthy population inference from these papers.
- These papers teach students how to fully comprehend the distribution of data by summarizing it by its center (mean, median, mode) and its dispersion (range, standard deviation).
- These papers teach students how to use Product Moment (linear) or Rank (monotonic) correlation to measure the direction and intensity of relationships. Crucially, they also teach them that correlation does not indicate causality.
- Using linear and non-linear curve fitting (such as exponential and power curves) and residual analysis, students gain knowledge about how to model and forecast variable connections.
- These papers teach students how to use moving averages to smooth time series data to spot patterns, carry out simple forecasting, and comprehend its limits.
- Students gain knowledge of the foundations of hypothesis testing, such as formulating hypotheses and analyzing p-values, from these papers. In particular, we learn how to choose the appropriate test and evaluate its findings, as well as when and how to use the Chi-square test for examining relationships or distributions of categorical data and the T-test for comparing means.

In the practical class the students will learn,

- These papers teach students how to relate qualities to geographic units in order to organize spatial data, which is essential for mapping and analysis.
- Through these papers, students get a thorough grasp of statistics by learning how to analyze central tendency and dispersion, illustrate distributions using histograms and frequency curves, and summarize data using frequency tables.
- These papers teach students how to choose and use random, systematic, and stratified sampling techniques from a data matrix in real-world situations. Finding samples on a map and realizing how crucial it is to record the selected approach are part of this.
- These papers teach students how to use scatter diagrams and linear regression to study bivariate interactions. They also teach them how to map residuals to find spatial patterns in model mistakes for a better understanding.

Broad Content of course

- Data collection
- Sampling
- Theoretical distribution
- Central tendency
- Measures of dispersion range, mean deviation, standard deviation, coefficient of variation
- Association and correlation

- Regression
- Time series analysis
- Hypothesis testing

DS-18
GEOADS18T
(ADVANCE GEOMORPHOLOGY)
(Credit:5)

- Studying tectonic geomorphology helps students understand the Himalayas as an example of tectonic and structural landforms, revealing how the globe is shaped by internal forces. By examining thrust belts, foredeep basins, and metamorphic zones, they can learn about orogenic belt formation. Geomorphic markers like fault scarps help identify recent tectonic activity and date it using relative and absolute techniques, contributing to mountain building, landscape evolution, and geological hazards.
- Geomorphology teaches students about landscapes' history and their modification through abrupt and uniformitarian processes. Systems analysis uses thresholds and feedback to show dynamic evolution, while process studies quantify landscape change for management and forecasting. Morphogenetic areas emphasize climate, and planetary studies like Mars demonstrate universal processes.
- Students who study this topic will discover that drainage basins are basic geomorphic units that show how channels form and how water and sediment flow more broadly. Knowing stream hydraulics helps one to understand how flow energy and velocity control erosion (bank and bed) and subsequent deposition. Conversely, tropical humid karst is an example of fast chemical dissolution, generating unusual landscapes with significant subterranean drainage, whereas periglacial processes, driven by freeze-thaw cycles, provide distinctive cold-climate landforms.
- Students who study coastal geomorphology will discover how sediment, tides, waves, and bioturbation—including storm surges and bioturbation—shape coastal formations. Frameworks for comprehending long-term hillslope changes are offered by slope evolution models (King, Wood, Young). Lastly, geoinformatics (satellite pictures, DEMs) provides essential tools for contemporary geomorphic analysis, while applied and anthropogenic geomorphology emphasizes human influences and real-world applications.

Broad Content of course
- Principle of y geomorphology
- Systems Analysis in Geomorphology
- Tectonic Geomorphology
- Morphogenetic regions and their importance
- Significance of drainage basin and channel initiation
- Hydraulics of streamflow
- Process of landforms evolution
- Evolution of coastal forms
- Slope evolution models
- Applied and anthropogenic geomorphology

DS-19
GEOADS19T
(REGIONAL DEVELOPMENT AND PLANING)
(Credit:5)

- Students may learn that regions are specified geographic units (functional, formal, or vernacular) used for planning and analysis by studying this topic. We are also aware of the distinction between qualitative and quantitative development, which are evaluated by a variety of environmental, demographic, and economic indices to gauge the advancement of society.

- By studying this topic, students may discover that India has large regional economic and social differences in infrastructure, income, and access to essential services, which are caused by a number of historical and geographic causes. Using tactics like growth pole or target area development and concepts like comprehensive and participatory approaches, regional planning seeks to counteract this and promote balanced and sustainable development.
- Students can learn about the several types of planning methods—temporal, sectoral, spatial, and non-spatial—by studying this topic. With India serving as an example of multi-level planning to combine national objectives with local requirements, we also comprehend the distinctions between centralized and decentralized planning.
- Because of their different ecosystems and functional linkages, hill and city regions pose different planning issues, as students can discover when studying this subject. More and more, effective solutions depend on strong governance to ensure equitable and effective execution, together with participatory planning to incorporate all stakeholders.

Broad Content of course

- Regional concept, types, and delineation
- Concepts and indicator soft growth and development
- Theories and models for regional development
- Underdevelopment
- Regional disparities in India
- Types of regional planning
- Centralised and decentralised planning
- Planning issues and strategies

DS-20
GEOADS20T
(ADVANCE CLIMATOLOGY)
(Credit:5)

- Students may comprehend how ideal gas laws, atmospheric temperature, and thermodynamics control air's behaviour and energy changes by reading this course material. We also know how weather development is determined by atmospheric moisture, condensation, and stability, which propel the creation of clouds and precipitation.
- The fundamentals of atmospheric forces and how they affect wind patterns will be covered in this lesson. Students will learn how pressure, gravity, centripetal force, and the Coriolis effect propel the geostrophic and gradient winds that we see. Tropical meteorology will also be covered, including the traits of tropical wet and dry climates, how to spot and follow tropical air masses as they change, and the crucial roles that convergence (which causes rain) and divergence (which causes clear skies) play in determining the weather in these areas.
- The physics and variability of the Indian Monsoon, its relationship to global circulation patterns such as Hadley, Walker, and ENSO, and the causes and predictions of heat and cold waves in India will all be covered in this module.
- Students will learn about the scientific theories behind climate change in this module. These theories will include both natural and greenhouse gas-related processes, and they will be supported by a wealth of scientific data such as melting ice and rising global temperatures. Additionally, you'll discover how scientists use historical climate reconstruction to comprehend natural climate cycles, which puts present climate trends—particularly the fast, human-caused warming seen worldwide—into perspective.

- By exploring how climatic conditions affect human comfort and health, this subject will provide students a thorough grasp of bioclimatology. The application of synoptic climatology will next be covered, with particular attention to how it affects air pollution dispersion, aircraft safety, and efficient navigation. Urban climatology is another topic covered in the course, with an emphasis on the causes and effects of the urban heat island effect. Lastly, you'll learn about the many methods and strategies used in Indian weather forecasting, including short-, medium-, and long-term projections that are essential for a number of industries.

Broad Content of course

- Atmospheric Dynamics
- Climatology: - Concept, characteristics, identification and modification, convergence and divergence
- Theories of climate change
- Bioclimatology
- Synoptic and Urban climatology
- Approaches and techniques of weather forecasting in India

DS-21
GEOADS21T
(RURAL AND URBAN GEOGRAPHY)
(Credit:5)

- This paper explores various rural development paradigms, including Gandhian, Modernization, and Holistic approaches. It highlights self-sufficiency, decentralized governance, technology-based improvement, and integrated social, economic, and environmental progress. It also discusses target-based strategies like the National Food for Work Programme (NFFWP) and area-based strategies like the Drought Prone Area Programme (DPAP), which target vulnerable groups and focus on specific regions.
- This course paper explores India's rural development and governance framework, examining government programs like PMGSY, SJSY, MNREGA, and Jan Dhan Yojana, their impact on poverty alleviation and empowerment. It also examines India's 73rd Constitutional Amendment, which constitutionalizes Panchayati Raj institutions, promotes decentralized governance, and empowers local communities through grassroots democracy.
- This paper provides students with a comprehensive understanding of contemporary rural development methods, focusing on participatory planning and management. It also explores various theoretical approaches to studying cities and analyzes current trends influencing urban landscapes in India and globally, such as sustainability issues, smart city concepts, and rapid urbanization.
- The origins and development of urban areas during the ancient, medieval, modern, and post-modern eras are covered in this course paper, along with a description of their distinctive elements, phases, and traits. The diverse urbanization trends seen in industrialized and developing nations are then contrasted, emphasizing the disparities in their causes and related difficulties.
- Rural-urban migration is a significant factor in urbanization, affecting the rate of expansion and the emergence of megacities. However, inadequate provision of transportation, utilities, and adequate infrastructure, such as water, sanitation, and transportation, is a significant issue for the rapidly growing urban population in India. Addressing these issues is crucial for ensuring a sustainable and efficient urban environment.

Broad Content of course

- Paradigms of rural society:- Planning, management, approaches and development
- Rural Employment policies and programmes in India
- Approaches and recent trends in urban geography

- Origin of urban places
- Patterns and trends of urbanisation in India
- Urban issues

SKILL ENHANCEMENT COURSE (SEC)

SE-1
GEOSE-01M
(REMOTE SENSING)
(Credit:3)

- This paper examines remote sensing, using electromagnetic waves to gather Earth data, highlighting diverse data quality and temporal resolutions. Satellites like India's Cartosat and INSAT are categorized by orbit, and sensors by their light source (active or passive). This technology enables data analysis for disaster relief, agriculture, and environmental monitoring, proving highly beneficial for nations such as India
- This paper emphasizes understanding sensor resolutions (spatial, spectral, radiometric, temporal) in remote sensing. Missions like Landsat (medium resolution for global change) and India's IRS series showcase these, with data organized by reference schemes like Landsat's WRS for systematic collection and access in various applications.
- Picture rectification, augmentation (enhancement), and false color composites (FCCs) are vital for remote sensing. Rectification uses Ground Control Points (GCPs) to accurately align images to real-world coordinates. FCCs, especially with Landsat TM/OLI data, highlight features like healthy vegetation (appearing red). Together, these processes transform raw satellite data into comprehensible outputs for diverse applications.
- From satellite image interpretation, students learn to identify Earth's features using visual cues and classification methods. This skill then applies to creating Land Use/Land Cover (LULC) inventories, distinguishing physical cover from human use. LULC maps are vital for resource management, environmental monitoring, urban planning, and disaster assessment.

Broad Content of course

- Principles of Remote Sensing (RS): Classification of RS satellites and sensors
- Sensor resolutions and their applications with reference to IRS and Landsat missions, image referencing schemes and data acquisition
- Preparation of False Colour Composites from IRS LISS-3 and Landsat TM and OLI data. Principles of image rectification and enhancement
- Principles of image interpretation and feature extraction. Preparation of inventories of land use land cover features from satellite images

SE-2
GEOSE-02M
(ADVANCE SPATIAL STATISTICAL TECHNIQUES)
(Credit:3)

- This paper aims to teach students probability theory, including Poisson distributions, to evaluate risks, forecast events, and examine geographical randomization, thereby enhancing their ability to create reliable spatial research and quantify uncertainty.
- Theorem teaches sampling for reliable data inferences, covering spatial and non-spatial plans to ensure representative subsets and address spatial autocorrelation. Students learn about sampling distributions, Central Limit Theorem, estimation, and hypothesis tests for means and proportions, essential for geographical and environmental studies.
- Comprehensive modeling involves understanding and predicting geographical relationships through Regression models and Regression Analysis. These models use residuals to assess fit and forecast, extending to multivariate analysis for complex geographical systems, enhancing the understanding of geographical relationships.

- Techniques like Time Series Analysis are essential for understanding and predicting temporal geographical phenomena, such as urban patterns and climate change. These techniques help decompose time series into trend, seasonality, cyclic, and irregular components, enhancing the understanding and forecasting of geographical trends.

Broad Content of course

- Probability theory, probability density functions with respect to Normal, Binomial and Poisson distributions and their geographical applications
- Sampling: Sampling plans for spatial and non-spatial data, sampling distributions. Sampling estimates for large and small samples tests involving means and proportions
- Correlation and Regression Analysis: Rank order correlation and product moment correlation; linear regression, residuals from regression, and simple curvilinear regression. Introduction to multi-variate analysis
- Time Series Analysis: Time Series processes; Smoothing time series; Time series components

SE-3

GEOSE-03M

(RESEARCH METHODOLOGY)

(Credit:3)

- This course paper will help students learn about finding gaps and determining the path of a study are taught by clearly defining the research challenge, objectives, and hypothesis. In order to select the most effective study strategy, knowledge must be synthesized through literature reviews and research design formulation. Practical data collecting, analysis, sampling, and ethics for rigorous execution are covered in research materials and methodologies.
- You may learn how to organize, format (notes, references, bibliography, abstract, keywords), and effectively and accurately present research by taking a scientific report writing course. By stressing appropriate citation and preventing unintentional or deliberate intellectual theft, an understanding of plagiarism (its varieties and prevention) guarantees ethical academic conduct.
- Selecting study regions, pre-field preparations, and ethical concerns are just a few of the things that are taught when learning geographical fieldwork. Practical field methods like as participant and non-participant observation, open-ended and closed-ended surveys, and organized and unstructured interviews are also covered.
- Acquiring knowledge of these fieldwork methods teaches visual documentation through sketches, photographs, and videos, as well as methodical landscape surveys utilizing transects and quadrants. Additionally, it includes physical sample collection, exact sample placement (GPS), and inventory management for all field data.
- Post-field data handling, including tabulating, processing, and analyzing both quantitative (statistics, geographical analysis) and qualitative (thematic coding) data, is taught by mastering these fieldwork phases. With a focus on preparation, risk assessment, and safety procedures, it also covers essential fieldwork logistics and emergency handling.

Broad Content of course

- Research: - problem, objectives, hypothesis, materials, methods and design
- Techniques of writing scientific reports
- Classification and prevention of plagiarism
- Fieldwork, techniques, and tools
- Post-field tabulation, processing, and analysis of quantitative and qualitative data
- Positioning and Preparation of inventory from samples and field data

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3
GEOMD-01M/ GEOMD-02M/ GEOMD-02M
(GEOMETRICS AND SPATIAL ANALYSIS)
(Credit:3)

- This course teaches map fundamentals: scales, projections (including distortions, specifically UTM and simple conical), map components, and classification. We also learn to construct a simple conical projection. This understanding is crucial for accurately depicting Earth's features.
- This covers surveying fundamentals: understanding concepts and the capabilities of tools like GNSS, Dumpy levels, theodolites, and total stations. It also teaches practical traverse surveying and plotting UTM coordinates using smartphone GNSS apps, directly linking fieldwork to digital mapping.
- This topic teaches bearings (magnetic/true, whole-circle/reduced directions) and core geodetic concepts: geoid (Earth's irregular shape) and spheroid (mathematical approximation), with a focus on WGS-84 for precise global positioning.
- This section covers remote sensing (RS) basics, including the electromagnetic spectrum and satellite/sensor types (e.g., IRS, Landsat). Students learn practical RS skills like creating False Colour Composites (FCCs) and performing supervised image classification. Fundamental GIS functions such as attribute tables, data manipulation, querying, and overlay analysis are also taught for comprehensive geographical data analysis.
- GIS data types (spatial/non-spatial, raster/vector models) for handling geographic information are covered in this topic. False Color Composites (FCCs) are used to teach students how to interpret remote sensing data practically for Land Use/Land Cover (LULC) surveys. Lastly, it teaches how to use multi-dated maps and photos to spot changes, such as changes in the shoreline or riverbank, which are important for environmental management.

Broad Content of course

- Concept and applications of scales and map projections
- Knowledge survey
- Bearing
- Remote sensing
- Principle of GIS and data type of GIS
- Identification of land use / land cover features & Change detection of riverbank or coastline shift

For UG NEP2020 syllabus of Geography in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2025/08/Geography_UG_NEP-2020-MDC_Code-corrected.pdf
https://wbsu.ac.in/web/wp-content/uploads/2024/03/MDC_Geography.pdf

Program and Course Learning outcome of Undergraduate course

Department of History

BIDHANNAGAR COLLEGE

SALTLAKE

INTRODUCTION

The B.A. Major in History under the NEP 2020 syllabus at West Bengal State University is a revitalized, four-year honours-level program that immerses students in a broad sweep of global and Indian history through a multidisciplinary, research-oriented lens. The curriculum unfolds across eight semesters, beginning with foundational papers like “The Idea of Bharat” and “Aspects of Ancient India” and progressing through medieval and modern themes—covering British India, European transformations, world wars, nationalism, decolonization, and beyond—juxtaposed with regional and non-Western histories such as North-East India, China, Japan, and modern Southeast Asia. In later years, students engage in skill-building through internships, research, seminars, vocational studies, and value-added courses in heritage and environmental awareness. This structure not only fosters critical historiographical thinking and contextual analysis but also aligns with NEP 2020’s emphasis on interdisciplinarity, experiential learning, and development of soft, digital, and research competencies. Learners are encouraged to weave together theoretical insights, fieldwork, archival research, and scholarly discourse. The program prepares them for diverse futures—as educators, heritage professionals, policy analysts, archivists, or further scholars in history—while cultivating intellectually curious, socially conscious, and globally aware citizens.

Program and Course Learning outcome of Undergraduate course

Courses offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOMES	
PO1:	History offers the explanatory tools for understanding the past as well as the present. There has been a paradigm shift in the understanding of Indian history from the political narratives to cultural aspects over the years**.**
PO2:	The Courses offered in CCFUP (NEP 2020) pattern enables a student to understand the cultural past of not only the Indian Sub-continent but also of the Contemporary ancient World
PO3:	The Skill Enhancement courses offered will enable the students to gain practical knowledge like hands on training and would provide them with an edge over other applicants in the job market

PROGRAM SPECIFIC OUTCOMES	
PSO1:	Demonstrate a comprehensive understanding of the political, social, economic, and cultural history of India from prehistoric times to the contemporary period, using both primary and secondary sources.
PSO2:	Analyse world history across ancient, medieval, and modern periods, with emphasis on comparative developments, cross-cultural interactions, and global processes such as colonialism, industrialization, and globalization.
PSO3:	Apply historiographical approaches and theoretical frameworks to critically interpret historical events, processes, and structures, assessing multiple perspectives and contested narratives.
PSO4:	Acquire research skills, including archival use, oral history methods, fieldwork, and digital humanities tools, to investigate and present historical findings.
PSO5:	Interpret archaeological, epigraphic, numismatic, and art-historical evidence to reconstruct socio-economic and cultural life in different historical contexts.
PSO6:	Understand and evaluate regional histories of Bengal, North-East India, and other specific areas, situating them within broader national and global contexts.
PSO7:	Develop an informed awareness of heritage conservation, museum and archive management, and the significance of material culture in preserving historical memory.
PSO8:	Communicate historical knowledge effectively in written, oral, and digital forms, demonstrating academic integrity and adherence to scholarly conventions.
PSO9:	Engage with contemporary social, political, and cultural issues through a historical lens, fostering values of pluralism, tolerance, and civic responsibility.
PSO10:	Integrate concepts from multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of History.
PSO11:	Develop communicative skill and human values.

PO-CO MAPPING

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9	PSO-10	PSO-11
DS-1	✓		✓		✓			✓	✓	✓	✓
DS-2		✓	✓		✓			✓	✓	✓	✓
DS-3	✓		✓		✓			✓	✓	✓	✓
DS-4		✓	✓					✓	✓	✓	✓
DS-5	✓		✓		✓		✓	✓	✓	✓	✓
DS-6		✓		✓				✓	✓	✓	✓
DS-7	✓		✓		✓	✓		✓	✓	✓	✓
DS-8		✓	✓					✓	✓	✓	✓
DS-9	✓		✓		✓	✓		✓	✓	✓	✓
DS-10	✓		✓		✓	✓		✓	✓	✓	✓
DS-11		✓	✓					✓	✓	✓	✓
DS-12	✓		✓			✓		✓	✓	✓	✓
DS-13	✓		✓			✓		✓	✓	✓	✓
DS-14		✓	✓					✓	✓	✓	✓
DS-15	✓		✓			✓		✓	✓	✓	✓
DS-16		✓	✓					✓	✓	✓	✓
DS-17		✓	✓					✓	✓	✓	✓
DS-18			✓	✓				✓	✓	✓	✓
DS-19			✓	✓				✓	✓	✓	✓
DS-20	✓		✓		✓	✓		✓	✓	✓	✓
DS-21	✓		✓		✓	✓		✓	✓	✓	✓
MA-1/MB-1	✓				✓				✓	✓	
MA-2/MB-2	✓				✓				✓	✓	
MA-3/MB-3	✓				✓				✓	✓	
SM-1/SM-2										✓	
MD-1/MD-2/MD-3	✓								✓	✓	
AE-1											✓
AE-2											✓
AE-3											✓
SE-1				✓	✓		✓				
SE-2						✓		✓			
SE-3				✓	✓		✓			✓	
VA-1											✓
VA-2											✓

COURSE LEARNING OUTCOME

DEPARTMENT SPECIFIC COURSE (DSC)

DS 1
HISDSC101T
History of India – I (From Earliest Times to c.300 BCE)

After completion of the course the students will

- Understand the cultural, political, and economic foundations of ancient India through archaeological and literary sources.
- Gain insight into the development of early human societies, Harappan civilization, and Vedic culture.

DS 2
HISDSC202T
Aspects of the History of the Ancient World

After completion of the course the students will

- Analyse the evolution of early civilizations, including Mesopotamia, Egypt, Greece, and Rome, and their socio-political structures.
- Explore the impact of religion, philosophy, and imperial expansion on ancient societies

DS 3
HISDSC303T
History of India – II (c.300 BCE to 750 CE)

After completion of the course the students will

- Examine state formation, religious developments, and regional cultures during the Maurya to early medieval period.
- Study the spread of Buddhism and Jainism, and the role of Gupta and post-Gupta polities.

DS 4
HISDSC404T
Aspects of the History of the Medieval World

After completion of the course the students will

- Explore medieval European and Islamic worlds, focusing on feudalism, religion, trade, and cultural exchanges.
- Understand the transformations brought by the Crusades, Islamic caliphates, and scholasticism.

DS 5
HISDSC405T
History of India - III (750 CE–1206 CE)

After completion of the course the students will

- Trace the rise of regional powers, early Islamic influences, and socio-economic transformations in early medieval India.
- Examine temple architecture, agrarian expansion, and regional literary cultures.

DS 6
HISDSC406T
Rise of Modern West - I (15th – 16th Centuries)

After completion of the course the students will

- Understand Renaissance, Reformation, and the Age of Exploration as foundations of the modern West.

- Investigate changing worldviews, the humanist tradition, and the beginnings of European colonialism.

DS 7
HISDSC407T
History of India - IV (1206 CE–1526 CE)

After completion of the course the students will

- Study the Delhi Sultanate’s political, cultural, and economic impact on medieval India.
- Analyse administrative reforms, Indo-Islamic culture, and patterns of resistance and assimilation.

DS 8
HISDSC508T
Rise of Modern West - II (17th – 18th Centuries)

After completion of the course the students will

- Evaluate the Scientific Revolution, Enlightenment, and early capitalist and colonial expansion in shaping modern Europe.
- Explore the philosophical foundations of modern political thought and revolutions.

DS 9
HISDSC509T
History of India - V (1526 CE–1757 CE)

After completion of the course the students will

- Analyse the Mughal Empire’s political structure, cultural achievements, and its decline.
- Understand regional kingdoms, socio-religious movements, and economic shifts during the period.

DS 10
HISDSC510T
History of India - VI (1757 CE–1857 CE)

After completion of the course the students will

- Explore the consolidation of British power and its economic, social, and cultural implications for Indian society.
- Study early resistance movements and transformations in traditional institutions.

DS 11
HISDSC511T
History of Modern Europe (1789 CE–1919 CE)

After completion of the course the students will

- Assess the impact of revolutions, nationalism, industrialization, and World War I on Europe’s transformation.
- Examine the role of ideology, class conflict, and diplomatic relations in shaping modern Europe.

DS 12
HISDSC612T
History of India - VII (1858 CE–1947 CE)

After completion of the course the students will

- Understand the growth of Indian nationalism and the socio-political movements leading to independence.

- Analyse the role of reform movements, political parties, and colonial policies.

DS 13
HISDSC613T
History of India - VIII (India 1947–1977 CE)

After completion of the course the students will

- Analyse post-independence nation-building, democratic institutions, and major socio-political developments.
- Explore economic planning, foreign policy, and the challenges of national integration.

DS 14
HISDSC614T
Trends in World Politics (1919 CE–2001 CE)

After completion of the course the students will

- Examine global political shifts, including the World Wars, Cold War, decolonization, and post-Cold War order.
- Study the evolution of international organizations, ideologies, and power dynamics.

DS 15
HISDSC615T
West Bengal in Transition (1947 CE–1977 CE)

After completion of the course the students will

- Explore socio-economic, political, and cultural changes in West Bengal during the early post-independence period.
- Understand the regional impact of national policies, political movements, and refugee resettlement.

DS 16
HISDSC716T
History of Modern East Asia - I: China (1839 CE–1949 CE)

After completion of the course the students will

- Study China's encounter with imperialism, internal reforms, revolution, and the rise of communism.
- Analyse the Opium Wars, Taiping Rebellion, and the emergence of modern Chinese nationalism.

DS 17
HISDSC717T
History of Modern East Asia - II: Japan (1854–1945)

After completion of the course the students will

- Examine Japan's modernization, imperial expansion, and role in global conflicts up to WWII.
- Understand the Meiji Restoration, militarization, and socio-political transformations.

DS 18
HISDSC818T
Historiography: Meaning & Scope of History, Approaches to History

After completion of the course the students will

- Understand the evolution of historical writing and various theoretical approaches to studying history.
- Critically assess the influence of ideologies, schools of thought, and interdisciplinary methods in historiography.

DS 19
HISDSC819T
Historical Methodology: Historical Evidence & Interpretation

After completion of the course the students will

- Gain skills in using sources, evidence, and critical methods for historical analysis and interpretation.
- Learn to construct historical arguments and evaluate differing perspectives.

DS 20
HISDSC820T
Modern Bengal (1757–1905)

After completion of the course the students will

- Explore Bengal's transformation under colonial rule and the socio-political movements that emerged resultingly.
- Study the Permanent Settlement, emergence of the middle class, and reformist ideologies.

DS 21
HISDSC821T
Modern Bengal (1905–1947)

After completion of the course the students will

- Analyse nationalist, communal, and cultural developments in Bengal leading to independence and partition.
- Understand the roles of major leaders, organizations, and the impact of the freedom movement on the region.

SKILL ENHANCEMENT COURSE (SEC)
SE-1
HISHSE101M
Archives and Museums in India

- This paper will help the students to form the concepts on Archives and Museum and the roles of both in reconstructing history.
- It teaches the students how to collect information from the Archives and Museums and the processes of the preservation of the historical documents and artifacts in the Archive and Museum with practical observation.

SE-2
HISHSE202M
Understanding Indian Art

- This paper will make the students familiar with the art and architecture of India from the earliest time to the independence of India.
- It traces the different forms of architectures of early-medieval India, Sultanate and Mughal period.

- It also traces the evolution of painting from Mughal period to the independence of India. Students will understand the rich heritage of our country with this paper.

SE-3
HISMSE101M
An Introduction to Archaeology

- This paper will make the students conscious about how to preserve artifacts, archaeological sites and monuments.
- It takes the students to the endeavours of early archaeologists like Alexander Cunningham, John Marshall etc. and the patronages that they had received from colonial government It also help the students to form knowledge about the methodologies to use the artifacts in reconstructing the history.
- The process of the archaeological excavation will also be taught in this paper.

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3
HISHMD101M/ HISHMD2101M/ HISHMD3101M
India's Freedom Struggle (1857-1947)

This paper will make the students familiar with the mainstream politics of Indian national movement after 1857 revolt in the form of pre-Gandhian congress politics, Gandhian politics and the so called high politics and communal politics before independence which led to the partition of India. Students will also understand the shift from so called pre-Gandhian elite congress politics to the mass politics that introduced by Gandhi and also the evolution of the ideology of Gandhi in the form of non-violence and Swaraj in the non-co-operation, civil disobedience and quite India movement.

For UG NEP2020 draft syllabus of History in West Bengal State University click link bellow: https://wbsu.ac.in/web/wp-content/uploads/2024/11/History-syllabus.NEP_.Modified.pdf

Program and Course Learning outcome of Undergraduate course

Department of Mathematics

BIDHANNAGAR COLLEGE

SALT LAKE

INTRODUCTION

The B.Sc. Major in Mathematics under the NEP 2020 curriculum at West Bengal State University is a comprehensive and flexible four-year Honours program designed to develop deep theoretical understanding and practical problem-solving skills in mathematics. The curriculum starts with fundamental courses like Calculus, Linear Algebra, Abstract Algebra, Real Analysis, Differential Equations, and Geometry in the early semesters, gradually advancing to specialized subjects such as Complex Analysis, Metric Spaces, Numerical Methods, Probability & Statistics, and electives like Topology, Fluid Dynamics, and Mathematical Modelling in later years. In line with NEP's interdisciplinary ethos, the program incorporates practical lab-based components—such as Numerical Methods labs and computational projects—and opportunities for field-oriented or vocational courses, skill-based workshops, and seminars. It also includes multidisciplinary and skill-enhancement courses like Basic Logic, Programming (e.g., C and Python), communication, and community-connected activities. Through a combination of theoretical lectures, tutorials, hands-on practical, projects, and optional dissertation-like research in the final year, students cultivate critical reasoning, computational proficiency, digital literacy, and scientific communication skills. Guided by experienced faculty and supported by a learner-centric credit-based framework, the B.Sc. Major in Mathematics equips graduates for diverse careers in academia, data science, finance, research, teaching, and technology, as well as providing a strong foundation for advanced studies in pure or applied mathematics.

Program and Course Learning outcome of Undergraduate course

Courses offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOMES	
PO1	Basic Concept: Ability to interpret and analyse various concepts and theories
PO2	Understanding real life application: An understanding application of various methods and apply in real life problem.
PO3	Research and Innovation: Use of knowledge to identify a wide range of contemporary problems and issues and acquire research skills to produce a well-researched written work using geographical research tools.
PO4	Critical thinking: Able to identify critical problems. Programme Outcomes (POs) matrix (Core)

PROGRAM SPECIFIC OUTCOMES	
PSO1	In-depth knowledge: Understand the concepts and processes related to an academic field of study and demonstrate the applicability of their domain knowledge and its links to related disciplinary areas/subjects of study.
PSO2	Specialised knowledge and skills: Demonstrate procedural knowledge and skills in areas related to one's specialization and current developments, including a critical understanding of the latest developments in the area of specialization, and an ability to use established techniques of analysis and enquiry within the area of specialization.
PSO3	Analytical and critical thinking: Demonstrate independent learning, analytical and critical thinking of a wide range of ideas and complex problems and issues.
PSO4	Research and Innovation: Demonstrate comprehensive knowledge about current research in the subject of specialization, critical observation to identify research problems and to collect relevant data from a wide range of sources, analysis and interpretation of data using methodologies as appropriate to the area of specialization for formulating evidence-based research output.
PSO5	Interdisciplinary Perspective: Commitment to intellectual openness and developing understanding beyond subject domains.
PSO6	Communication Competence: Demonstrate effective oral and written communicative skills to covey disciplinary knowledge and to communicate the results of studies undertaken in an academic field accurately in a range of different contexts using the main concepts, constructs and techniques of the subject(s) of study
PSO7	Career development: Show proficiency in academic, professional, soft skills and employability required for higher education and placements.
PSO8	Teamwork: Work in teams with enhanced interpersonal skills leadership qualities
PSO9	Commitment to the society and the Nation: Recognize the importance of social, environmental, human, and other critical issues faced by humanity at the local, national and international level; appreciate the pluralistic national culture and the importance of national integration.
PSO10	Integrate concepts from multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Mathematics.
PSO11	Develop communicative skill and human values.

PO-CO MAPPING

	PROGRAMME SPECIFIC OUTCOME (PSO)										
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11
DSC-1	√	√	√	√		√	√			√	
DSC-2	√	√	√	√	√	√	√			√	
DSC-3	√		√	√	√	√	√			√	
DSC-4	√	√	√	√		√	√			√	
DSC-5	√	√	√	√	√	√	√			√	
DSC-6	√	√	√	√	√	√	√			√	
DSC-7	√	√	√	√		√	√			√	
DSC-8	√	√	√	√	√	√	√			√	
DSC-9	√	√	√	√	√	√	√			√	
DSC-10	√	√	√	√	√	√	√			√	
DSC-11	√	√	√	√	√	√	√			√	
DSC-12	√	√	√	√	√	√	√			√	
DSC-13	√	√	√	√		√	√			√	
DSC-14	√		√	√	√	√	√			√	
DSC-15	√	√	√	√	√	√	√			√	
DSC-16	√	√	√	√	√	√	√			√	
DSC-17	√	√	√	√	√	√	√			√	
DSC-18	√	√	√	√	√	√	√			√	
DSC-19	√	√	√	√		√	√			√	
DSC-20	√	√	√	√	√	√	√			√	
DSC-21	√	√	√	√	√	√	√			√	
MA-1/MB-1	√	√	√	√	√	√	√			√	
MA-2/MB-2	√	√	√	√	√	√	√			√	
MA-3/MB-3	√	√	√	√		√	√			√	
SM-1/SM-2	√	√	√	√	√	√	√			√	
MD-1/MD-2/MD-3	√	√	√	√		√	√			√	
AE-1											√
AE-2											√
AE-3											√
SE-1	√			√	√	√	√			√	
SE-2	√			√	√	√	√			√	
SE-3											
VA-1											√
VA-2											√

COURSE LEARNING OUTCOME

MAJOR COURSES (DSC – Department Specific Course)

DS-1
MTMDSC101T
Algebra
(Credits: 5)

1. Understand and apply De Moivre's Theorem to raise complex numbers to integer and rational powers in polar form.
2. Visualize and interpret geometric representations of complex roots on the Argand diagram (e.g., n-th roots of unity forming regular polygons).
3. Analyse the behaviour and graph of polynomial functions, including end behaviour, turning points, and symmetry.
4. Solve higher-degree polynomial equations and systems involving polynomials using algebraic methods.
5. Understand and apply equivalence relations and demonstrate how they lead to natural partitions of a set.
6. Establish one-to-one correspondences (bijections) between sets to compare their sizes and determine cardinality, including both finite and infinite sets.
7. Identify and work with special types of matrices:
   Symmetric and skew-symmetric matrices (real entries)
   Hermitian and skew-Hermitian matrices (complex entries)
   Orthogonal matrices (real, with transpose as inverse)
   Unitary matrices (complex, with conjugate transpose as inverse)
8. Analyse the existence and uniqueness of solutions to linear systems using the determinant and rank of coefficient matrices.
9. Determine the rank of a matrix using elementary row operations, and apply relevant theoretical results without proofs.
10. Develop algorithmic problem-solving skills useful in engineering, data science, computer programming, and applied mathematics.
11. Classify and determine the nature of solutions (unique, infinitely many, or no solution) using the concept of rank.
12. Understand and construct equivalent systems of equations, preserving solution sets via elementary transformations.

DS-2
MTMDSC202T
Calculus
(Credits: 5)

1. Understand the formal ε–δ definition of a limit and apply it to verify the limit of a function at a point.
2. Apply rules of successive differentiation and compute higher-order derivatives of algebraic, exponential, and trigonometric functions.
3. State and apply Euler's theorem for homogeneous functions and its converse to simplify expressions involving partial derivatives.
4. Develop a strong foundation in differential calculus required for applications in physics, engineering, optimization, and multivariable calculus.
5. State and apply Rolle's Theorem, Lagrange's Mean Value Theorem (LMVT), and Cauchy's Mean Value Theorem (CMVT), along with understanding their conditions and implications.
6. Apply Mean Value Theorems to derive and prove inequalities, and to study the increasing/decreasing nature of functions.

7. Understand and use Taylor's Theorem with remainder to approximate functions near a point using polynomials.
8. Integrate rational and irrational functions using appropriate substitution, algebraic simplification, and standard techniques.
9. Recognize and solve special standard integrals, including those involving trigonometric, logarithmic, and exponential functions.
10. Understand and compute Beta and Gamma functions, and apply their properties in solving definite and improper integrals.
11. Find equations of the tangent and normal to a curve at a given point and interpret their geometric significance.
12. Compute the length of a plane curve using arc length formulas in both Cartesian and parametric/polar forms.
13. Determine the curvature and radius of curvature of curves in Cartesian and polar forms.

DS-3
MTMDSC303T
Analytical Geometry and Vector Analysis
(Credits: 5)

1. Apply translation and rotation of coordinate axes to simplify general second-degree equations and eliminate cross-product terms.
2. Determine the angle between a pair of straight lines represented by a homogeneous second-degree equation.
3. Find equations of the tangent, normal, and chord of contact to conic sections from a given point.
4. Understand the concepts of poles and polars with respect to conics and apply them in geometric problem-solving.
5. Formulate the equation of a plane passing through three non-collinear points, using both scalar and vector methods.
6. Determine conditions for parallel and perpendicular between two planes using their coefficients or normal vectors.
7. Recognize and work with a pair of planes represented by a second-degree homogeneous equation in three variables.
8. Understand and derive the standard and general equations of a sphere, and solve problems involving spheres in 3D space.
9. Understand and work with paraboloids (elliptic and hyperbolic) and identify their geometric characteristics.
10. Express the general second-degree equation in three variables and reduce it to canonical form using coordinate transformations.
11. Understand and construct enveloping cones and reciprocal cones, and derive their equations geometrically and algebraically.

DS-4
MTMDSC404T
Ordinary Differential Equations-I and Mechanics-I
(Credits: 5)

1. Understand the basic structure of ODEs including the classification into nth-order, linear, and nonlinear differential equations.
2. Interpret solutions geometrically, understanding the meaning of slope fields and solution curves.
3. Understand and find orthogonal trajectories of families of curves using first-order ODEs.
4. Distinguish between homogeneous and non-homogeneous linear equations and apply appropriate solution techniques to each

5. State and apply key properties of linear systems and linear differential equations (statements only, without proof), such as superposition principle and uniqueness.
6. Develop analytical problem-solving skills relevant to applications in physics, engineering dynamics, electrical circuits, and control systems.
7. Draw and interpret phase planes and phase trajectories, providing a geometric understanding of solution behaviour over time.
8. Analyse the stability of critical points using linearization techniques and study how local behaviour reflects the system's dynamics.
9. Develop foundational knowledge for advanced topics in dynamical systems, nonlinear analysis, control theory, and applied mathematics.
10. Understand and analyse coplanar systems of forces, including concurrent, parallel, and general force systems, and determine conditions for equilibrium.
11. Build foundational skills required for studying rigid body mechanics, structural engineering, robotics, and applied mechanics.
12. Understand and define key kinematic quantities such as displacement, velocity, and acceleration for a particle moving along a curve in a plane.
13. Use the principle of conservation of linear and angular momentum in systems involving collisions, central forces, and rotational dynamics.

DS-5
MTMDSC405T
Real Analysis-I
(Credits: 5)

1. Understand and apply the algebraic and order properties of the real numbers $\mathbb{R}$, including basic operations, ordering, and inequalities.
2. Apply the Bolzano-Weierstrass Theorem to prove that every bounded infinite subset of R
3. Build a strong foundation for real analysis, topology, and advanced mathematics involving rigorous set-based reasoning and limits.
4. Apply algebraic operations on sequences and use limit theorems to compute and analyze the limits of sequences.
5. Identify and analyse monotone sequences, and apply the Monotone Convergence Theorem to determine convergence.
6. Apply Cauchy's Convergence Criterion to determine whether a given sequence in R independently of its limit.
7. Apply the necessary condition for convergence of a series and recognize when a series fails to converge based on its general term.
8. Distinguish between absolute and conditional convergence and apply relevant tests to verify each case.
9. Apply knowledge of series in solving mathematical problems in analysis, approximations, and mathematical modelling in science and engineering.
10. Apply the sequential criterion for limits to verify convergence or divergence of functions using sequences.
11. Evaluate and interpret infinite limits and limits at infinity, and use them to understand function behaviour near asymptotes or at infinity.
12. Understand and distinguish uniform continuity from pointwise continuity, and apply the Uniform Continuity Theorem on closed, bounded intervals.
13. Develop a deep conceptual understanding of limits and continuity, forming the foundation for advanced topics in real analysis, calculus, and topology.
14. Understand the concept of differentiability of a real-valued function at a point and over an interval.

15. Understand the intermediate value property of derivatives and apply Darboux's Theorem to demonstrate that derivatives may not be continuous but still possess this property.
16. Understand the intermediate value property of derivatives and apply Darboux's Theorem to demonstrate that derivatives may not be continuous but still possess this property.
17. Understand the intermediate value property of derivatives and apply Darboux's Theorem to demonstrate that derivatives may not be continuous but still possess this property.

DS-6
MTMDSC406T
Group Theory-I and Number Theory
(Credits: 5)

1. Define and distinguish between semigroups and groups, and identify the conditions under which a semigroup becomes a group.
2. Define and work with centralizers and centres of a group, and analyse how these subsets influence the structure of a group.
3. Compute the inverse and order of a permutation, and decompose permutations into disjoint cycles and transpositions.
4. Explore cyclic groups, their generators, and properties such as subgroup structure and orders.
5. Identify and verify normal subgroups, and understand their role in constructing quotient groups.
6. Apply abstract algebraic structures to model symmetries, transformations, and other mathematical phenomena.
7. State and apply Cauchy's Theorem for finite abelian groups, and understand the converse of Lagrange's Theorem in the context of abelian groups.
8. Use Euclid's lemma and the Euclidean algorithm for computing the greatest common divisor (GCD) and for proving divisibility results.
9. Apply Fermat's Little Theorem and Wilson's Theorem in modular arithmetic and cryptographic contexts.
10. Develop problem-solving skills in elementary number theory, which are essential in cryptography, computer science, coding theory, and pure mathematics.
11. Identify and compute primitive roots modulo a prime number, and understand their significance in number theory and cryptography.
12. Use quadratic reciprocity and related theorems in practical problem solving, including congruence solving and theoretical proofs.
13. Develop a strong conceptual understanding of modular arithmetic, primitive roots, and quadratic residues, forming a foundation for advanced number theory and cryptographic algorithms.

DS-7
MTMDSC407T
Partial Differential Equations & Integral Transforms
(Credits: 5)

1. Interpret the geometrical meaning of linear and quasi-linear PDEs and determine complete, particular, general, and singular integrals.
2. Use the Cauchy method of characteristics to find integral surfaces for certain types of PDEs.
3. Apply the method of separation of variables to solve homogeneous linear PDEs.
4. Hyperbolic: Wave equation (1D), D'Alembert's solution, vibrations of a finite string, domain of dependence and influence.
5. Gain expertise in solving classical PDEs arising in heat transfer, wave propagation, fluid flow, and electrostatics.
6. Understand the definition and basic properties of the Fourier transform, including linearity, shifting, scaling, and modulation.
7. Apply the inverse Fourier transform to reconstruct original functions from their transform domain.

8. Understand sufficient conditions for existence of Laplace transforms, and apply them to a wide class of functions.
9. Apply Parseval's relation for Hankel transform to relate energy norms in original and transform domains.
10. Apply Fourier, Laplace, and Hankel transforms to simplify and solve complex differential equations and boundary value problems.

DS-8
MTMDSC508T
Real Analysis-II
(Credits: 5)

1. Apply the Riemann sum definition to compute definite integrals.
2. Distinguish between Riemann integrability and non-integrability using upper and lower sums.
3. Explain Darboux's theorem and Riemann's condition for integrability.
4. Utilize Fundamental Theorem of Calculus to compute definite integrals.
5. Distinguish between pointwise convergence and uniform convergence of sequences of functions.
6. Apply criteria (Cauchy criterion, Weierstrass M-Test) to determine convergence.
7. Assess continuity, differentiability, and integrability of the limit of a sequence of functions.
8. Analyse convergence of series of functions and their sum's properties (continuity, differentiation).
9. Define Fourier coefficients and the representation by a Fourier series.

10. Apply Riemann–Lebesgue lemma, Bessel's inequality, Parseval's identity in context.
11. Determine convergence of a Fourier expansion under Dirichlet's conditions.
12. Provide examples of convergence and sum of Fourier series.
13. Determine the radius of convergence for power series (Cauchy–Hadamard theorem).
14. Perform differentiation and integration of power series within their interval of convergence.
15. Apply Abel's theorem to investigate convergence at boundary points.

DS-9
MTMDSC509T
Ring Theory and Linear Algebra-I
(Credits: 5)

1. Define rings and identify examples of rings.
2. Determine the characteristic of a ring.
3. Identify subrings, subfields, and ideals.
4. Perform operations with ideals and construct factor rings.
5. Explain ideals generated by a subset, principal ideals, and PID (Principal Ideal Domains).
6. Define rings and identify examples of rings.
7. Explain properties of rings, integral domains, and fields.
8. Determine the characteristic of a ring.
9. Identify subrings, subfields, and ideals.
10. Perform operations with ideals and construct factor rings.
11. Explain ideals generated by a subset, principal ideals, and PID (Principal Ideal Domains).
12. Define rings and identify examples of rings.
13. Explain properties of rings, integral domains, and fields.
14. Determine the characteristic of a ring.
15. Identify subrings, subfields, and ideals.
16. Perform operations with ideals and construct factor rings.
17. Explain ideals generated by a subset, principal ideals, and PID (Principal Ideal Domains).
18. Define rings and identify examples of rings.

19. Explain properties of rings, integral domains, and fields.
20. Determine the characteristic of a ring.
21. Identify subrings, subfields, and ideals.
22. Perform operations with ideals and construct factor rings.
23. Explain ideals generated by a subset, principal ideals, and PID (Principal Ideal Domains).

Group B: Linear Algebra-I

1. Understand the structure and properties of vector spaces and subspaces with relevant examples.
2. Perform operations on subspaces including sum, intersection, and direct sum.
3. Analyse vectors through linear combinations, span, linear independence, and determine basis and dimension.
4. Compute and interpret the row space, column space, null space, and left null space of a matrix.
5. Understand and prove the equality of row rank, column rank, and overall rank of a matrix.
6. Understand inner product spaces and norms through examples.
7. Apply the Cauchy-Schwarz inequality to problems involving angles, projections, and orthogonality.
8. Understand and use concepts of orthogonality, orthogonal complements, and orthonormal sets.
9. Define and understand the properties of linear transformations between vector spaces.
10. Apply the Rank-Nullity Theorem to analyse transformations.
11. Perform and understand algebraic operations on linear transformations.
12. Represent linear transformations by matrices, and vice versa.
13. Understand linear functional, dual spaces, and dual bases.
14. Explore bi-dual spaces and comprehend the concepts of covariant and contravariant vectors.
15. Analyse Eigen spaces, and understand the concept of invariant subspaces under a linear operator.

DS-10

MTMDSC510M

Numerical Analysis (Theory & Practical) (Credits: 5; Theory:3, Practical:2)

1. Understand how real numbers are represented on a computer using fixed point and floating point formats.
2. Identify and analyse sources of numerical error, including round-off, truncation, and propagation of error in computations.
3. Compute extreme eigenvalues using the Power Method.
4. Understand and use finite differences and shift operators in numerical interpolation.
5. Implement numerical integration methods.
6. Solve ordinary differential equations (ODEs) numerically.
7. Apply finite difference methods to partial differential equations (PDEs).
8. Implement numerical methods in C to find roots of transcendental and algebraic equations.
9. Analyse the accuracy and convergence behaviour of each method through actual computation.
10. Develop C programs for solving systems of equations using.
11. Understand matrix-based problem-solving techniques and assess convergence for iterative methods.
12. Use numerical integration in C for definite integrals.
13. Develop programming proficiency in C for solving numerical problems.
14. Translate mathematical algorithms into executable code and debug them.
15. Interpret and validate numerical results through experimentation and theoretical comparisons.
16. Strengthen understanding of numerical analysis concepts through computational implementation.

DS-11

MTMDSC511T

Multivariate Calculus and Metric Spaces

(Credits: 5)

Group A: Group B: Metric Spaces

1. Understand the concepts of limit and continuity for functions of two or more variables.
2. Compute partial derivatives, and determine total differentiability and conditions for differentiability.
3. Apply the chain rule for functions with one or two independent parameters.
4. Calculate directional derivatives and understand the gradient vector, including its maximal and normal properties.
5. Determine tangent planes to surfaces at given point.
6. Evaluate double integrals over rectangular and non-rectangular regions.
7. Convert and compute double integrals in polar coordinates.
8. Compute triple integrals over parallelepipeds and general solid regions.
9. Apply triple integrals to find volumes of 3D objects.
10. Understand and define vector fields, and compute their divergence and curl.
11. Evaluate line integrals of vector fields and apply them in physical and geometrical contexts.
12. Apply the Fundamental Theorem for Line Integrals and recognize conservative vector fields.
13. Understand and determine the independence of path in vector fields.
14. Apply Green's Theorem to compute area and circulation.

Group B: Metric Spaces

1. Understand the definition of a metric space and recognize standard and non-standard examples.
2. Identify and work with basic topological concepts in metric spaces.
3. Distinguish between continuity and uniform continuity, and apply these ideas in analysis.
4. Understand the concept of connectedness, prove connectedness of specific sets, and use properties of connected spaces.
5. Analyse the behaviour of continuous functions on compact sets, including their boundedness and attainability of extrema.
6. Understand contraction mappings and apply the Banach Fixed Point Theorem.
7. Use the Banach Fixed Point Theorem to prove existence and uniqueness of solutions to certain first-order ordinary differential equations.

DS-12

MTMDSC612T

Operations Research and Game Theory

(Credits: 5)

1. Understand the origin, development, and scope of Operations Research (OR).
2. Identify the characteristics, objectives, and limitations of OR in real-world applications.
3. Formulate mathematical models for real-life decision-making problems.
4. Understand the theory of the Simplex Method and identify conditions for optimality and unboundedness.
5. Apply the Simplex Algorithm using tableau format for solving LPPs.
6. Understand the concept of degeneracy in LPPs and apply methods for its resolution.

7. Analyse and formulate the dual of a given primal LPP.
8. Apply the Complementary Slackness Theorem.
9. Implement the Revised Simplex Method for computational efficiency.
10. Perform Post Optimality (Sensitivity) Analysis, including.
11. Understand the structure of two-person zero-sum games and formulate payoff matrices.

12. Identify pure and mixed strategies, and determine saddle points and optimal strategies.
13. Analyse value of the game and apply game theory to competitive decision-making scenarios.

DS-13
MTMDSC613T
Group Theory-II and Ordinary Differential Equations-II
(Credits: 5)

Group A: Group Theory-II

1. Understand and distinguish between external and internal direct products of groups.
2. Establish isomorphism between external and internal direct products through structure-preserving mappings.
3. Understand group actions, and compute orbits and stabilizers.
4. Apply the Extended Cayley's Theorem to represent groups as permutation groups.
5. Use the Index Theorem and group actions on sets (including action by conjugation).
6. Understand the concept of composition series and identify them in finite groups.
7. State and apply the Jordan–Hölder Theorem to compare composition series and understand the uniqueness of composition factors.
8. Define and characterize solvable groups, and explore their relevance in group theory and Galois Theory.
9. Analyse group behaviour via actions, orbits, stabilizers, and apply Sylow theory to determine subgroup structure.

Group B: Ordinary Differential Equations-II

1. Understand and apply power series methods to solve second-order linear ordinary differential equations (ODEs).
2. Identify and classify ordinary points and regular singular points of differential equations.
3. Analyse the behaviour of solutions near singularities, including recognizing the point at infinity as a regular singular point.
4. Understand and solve the hypergeometric differential equation and study the hypergeometric series as a solution.
5. Analyse and solve Legendre's and Bessel's equations in the real domain, and study their applications in physics and engineering.
6. Understand and solve self-adjoint second-order differential equations and identify Sturm-Liouville problems.
7. Apply Sturm's separation and comparison theorems to study the behaviour of solutions.
8. Apply series solutions to second-order ODEs around ordinary and singular points.
9. Analyse and utilize special functions like Legendre and Bessel functions in applied problems.

DS-14
MTMDSC614T
Probability & Statistics
(Credits: 5)

1. Understand and apply the axiomatic definition of probability, and compute probabilities in sample spaces.
2. Solve problems involving conditional probability and Bayes' Theorem.
3. Identify and work with independent events.
4. Understand and analyse joint distribution functions and their properties.
5. Derive and interpret marginal and conditional distributions from joint pdfs/pmfs.

6. Calculate expectation of functions of two random variables and conditional expectations.
7. Understand and apply Chebyshev's inequality to bound probabilities.
8. Interpret and distinguish between convergence in probability, and the weak and strong laws of large numbers.
9. Understand the concepts of random samples and sampling distributions.
10. Work with exact and asymptotic sampling distributions, especially in sampling from normal populations.
11. Model uncertainty using probability theory.
12. Analyse and interpret data using a wide range of distributions and statistical tools.
13. Conduct inference using sampling theory, estimation methods, and hypothesis testing.

DS-15
MTMDSC615T
Complex Analysis
(Credits: 5)

1. Understand the spherical representation of complex numbers and its geometric significance.
2. Explain the concept of the Riemann Sphere and perform stereographic projection from the complex plane to the sphere.
3. Calculate distances between stereographic projections and understand the topology of the extended complex plane.
4. Define and analyse the behaviour around the point at infinity and its deleted neighbourhood.
5. Understand functions of a complex variable, and analyse their limits, continuity, and differentiability.
6. Distinguish between analytic and non-analytic functions with examples.
7. Work with fundamental complex functions: exponential, logarithmic, and trigonometric functions.
8. Apply the Cauchy-Riemann equations and identify conditions for analyticity.
9. Evaluate complex integrals along paths and understand the addition and orientation of paths.
10. Define contours and compute contour integrals, applying bounds for modulus.
11. Study convergence of power series using Abel's Theorem and Cauchy-Hadamard Theorem.
12. Analyse analyticity of power series and apply Weierstrass' Theorem for uniformly convergent series.
13. Expand analytic functions using Taylor's and Laurent's series.
14. Understand meromorphic functions and their analytic structure.
15. Apply Cauchy's Residue Theorem to evaluate complex and real definite integrals.
16. Apply the Uniqueness Theorem and Maximum Modulus Theorem in function theory.
17. Understand basic properties of conformal mappings and their geometric implications.
18. Analyse and construct Mobius (linear fractional) transformations, and study their mapping behaviour on the extended complex plane.

DS-16
Course- MTMDSC716T
Topology (Credits: 5)

1. Define and identify topological spaces, bases, and sub-bases
2. Understand and analyze open, closed, interior, and closure sets along with their properties
3. Understand the Kuratowski closure operator and neighbourhood systems, and their role in generating topologies.
4. Characterize and provide examples of continuous, open, and closed maps.
5. Apply the pasting lemma in the context of continuous functions.
6. Understand homeomorphisms and identify topological invariants.
7. Explain the concept of hereditary properties in subspaces.

8. Understand and distinguish between the first and second countability axioms.
9. Analyze separability, Lindelöfness, and their interrelationships.
10. Characterize accumulation points in first countable spaces using sequences.
11. Apply Heine's continuity criterion in appropriate topological settings.
12. Define and give examples of T_0, T_1, T_2 (Hausdorff), T_3, $T_3½$, T_4, and T_5 spaces.
13. Understand the hierarchy and implications between different separation axioms.
14. Apply statements of Urysohn's Lemma and Tietze's Extension Theorem to relevant contexts.
15. Identify and construct examples of connected and disconnected spaces.
16. Understand connectedness on the real line and basic properties of connected spaces.
17. Describe and determine components of topological spaces.
18. Define compactness and explain its basic properties and characterizations.
19. State and understand the significance of Alexander's Subbase Theorem.
20. Analyze the behavior of continuous functions on compact sets.
21. Understand the relationship between compactness and separation axioms.
22. Construct product topologies on finite products of topological spaces.
23. Understand and apply projection maps.

DS-17
MTMDSC717T
Field Extension & Linear Algebra-II
(Credits: 5)

Group A: Field Extension

1. Define and provide examples of extension fields and determine their degree.
2. Distinguish between finite and infinite extensions, and algebraic and transcendental elements.
3. Analyze the structure of algebraic elements over a field.
4. Differentiate between algebraic and transcendental numbers.
5. Define and construct the splitting field of a polynomial over a given field.
6. Understand the existence and uniqueness (up to isomorphism) of splitting fields.
7. Characterize algebraic and transcendental extensions.
8. State and explain the Fundamental Theorem of Field Theory.
9. Define algebraic closure and algebraically closed fields.
10. Apply the Fundamental Theorem of Algebra.
11. Identify the prime field of a given field and describe its structure.
12. Define finite fields (Galois fields) and determine their order.
13. Classify finite fields and prove existence and uniqueness (up to isomorphism) of a finite field of given order.
14. Demonstrate isomorphisms between finite fields with the same number of elements
15. Define and work with the group of automorphisms of a field and its fixed field.
16. Define the Galois group of a polynomial and compute it in simple cases.
17. Understand and identify separable and normal extensions.
18. State and apply the Fundamental Theorem of Galois Theory (statement only).
19. Understand the solvability by radicals of polynomial roots and its connection to solvable Galois groups (statement only).

Group B: Linear Algebra-II

1. Define and compute the characteristic and minimal polynomials of a matrix.
2. Analyze the eigenspace of a matrix and compute algebraic and geometric multiplicities.
3. Determine whether a matrix is diagonalizable (semi-simple) and apply spectral decomposition to such matrices.
4. Understand the criteria for diagonalizability using eigenvalues and minimal polynomials.
5. Understand similarity of matrices and their classification.

6. Perform reduction to triangular form and compute determinant divisors and invariant factors.
7. Apply and interpret the Jordan canonical form for a matrix.
8. Recognize the rational canonical form (statement only) and understand through examples.
9. Define and analyze the adjoint of a linear operator and its properties.
10. Apply least squares approximation to overdetermined systems.
11. Perform QR factorization of matrices and use it for solving linear systems.
12. Identify and characterize normal, self-adjoint, and unitary operators.
13. Apply orthogonal projections in finite-dimensional inner product spaces.
14. State and apply the spectral theorem for self-adjoint and normal operators.
15. Define and analyze bilinear, quadratic, and Hermitian forms.
16. Classify positive definite Hermitian forms using principal minor criteria.
17. Apply the direct sum decomposition theorem for Hermitian forms.
18. Understand and compute the signature of a quadratic form.
19. Apply Sylvester's law of inertia to classify quadratic forms.

DS-18
MTMDSC818T
Functional Analysis
(Credits: 5)

1. Understand the foundational structure of metric spaces and key concepts like continuity, uniform continuity, completeness, compactness, and connectedness.
2. State and apply Hölder's and Minkowski's inequalities.
3. Apply Baire's Category Theorem to complete metric spaces.
4. State Banach's Fixed Point Theorem and apply it to obtain solutions of certain linear systems.
5. Distinguish between real and complex linear spaces and define normed linear spaces.
6. Understand the induced metric of a norm and the structure of Banach spaces.
7. Apply Riesz's Lemma in normed linear spaces.
8. Explore completeness and compactness criteria in finite-dimensional spaces and their quotient spaces.
9. Understand and compare equivalent norms.
10. Define bounded linear operators and express their norms in different forms.
11. Understand the structure and completeness of spaces of bounded operators.
12. Determine the inverse of a bounded linear operator (when it exists).
13. Define linear and sublinear functionals.
14. State and prove the Hahn–Banach theorem for real normed linear spaces and apply it to extend functionals and prove other results.
15. Define and provide examples of dual (conjugate) spaces.
16. Understand separability of the dual space and the concept of reflexivity.
17. Analyze weak and weak* convergence of sequences in normed spaces.
18. Apply the Uniform Boundedness Principle and use it in operator theory.
19. State and interpret the Open Mapping Theorem and the Closed Graph Theorem.
20. Define inner product spaces and identify Hilbert spaces with examples.
21. Analyze properties such as the continuity of the inner product, Cauchy–Schwarz inequality, parallelogram law, Pythagorean identity, and polarization identity.
22. Understand and apply concepts of orthogonality, orthonormal sets, and orthogonal complements.
23. Apply the Riesz Representation Theorem and Bessel's Inequality in Hilbert spaces.
24. Study convergence of series with orthogonal sequences, compute Fourier coefficients, and apply Parseval's Identity and Riesz–Fischer Theorem.

DS-19
MTMDSC819T
Mechanics-II
(Credits: 5)

1. Describe the kinematics of a system of particles using vector formalism.
2. Compute the Centre of Mass, linear momentum, and angular momentum of a system.
3. Apply conservation laws for linear and angular momentum.
4. Decompose kinetic energy and angular momentum with respect to and about the centre of mass.
5. Determine velocity and acceleration components in Cartesian, cylindrical, and spherical coordinates.
6. Understand the dynamics of a rigid body and its degrees of freedom.
7. Distinguish between body and space reference systems.
8. Define and apply Euler angles, infinitesimal rotations, and angular velocity.
9. Compute the inertia tensor, moments, and products of inertia.
10. Apply the parallel axis theorem and principal axis theorem.
11. Analyze the kinetic energy of rotation and use Euler's equations of motion.
12. Explain torque-free motion of a symmetric top.
13. Understand the dynamics of a rigid body and its degrees of freedom.
14. Distinguish between body and space reference systems.
15. Define and apply Euler angles, infinitesimal rotations, and angular velocity.
16. Compute the inertia tensor, moments, and products of inertia.
17. Apply the parallel axis theorem and principal axis theorem.
18. Analyze the kinetic energy of rotation and use Euler's equations of motion.
19. Explain torque-free motion of a symmetric top.
20. Classify and analyze holonomic, non-holonomic, schleronomic, and rheonomic constraints.
21. Define generalized coordinates and calculate degrees of freedom.
22. Apply D'Alembert's principle and principle of virtual work (statement only).
23. Derive and use Lagrange's equations for systems with holonomic constraints under conservative forces.
24. Understand ignorable coordinates, Routhian function, and Routh's equations.
25. Formulate Lagrange's equations for non-holonomic systems.
26. Define the Hamiltonian function and derive Hamilton's equations.
27. Express and interpret the kinetic energy and integral of energy for conservative systems.
28. Apply Hamiltonian formalism to time-independent constrained systems.
29. Analyze small oscillations around equilibrium and derive coupled equations of motion.
30. Understand normal modes and normal coordinates.
31. Apply Hamilton's principle and principle of least action to derive Lagrangian and Hamiltonian equations.
32. Perform canonical transformations using generating functions.
33. Define and use Poisson brackets and Lagrange brackets.
34. Understand phase space structure and apply Liouville's theorem.

DS-20

MTMDSC820T

Discrete Mathematics & Differential Geometry

(Credits: 5)

Group A: Discrete Mathematics

1. Understand and apply Huntington postulates and De Morgan's laws in Boolean algebra.
2. Construct and simplify Boolean expressions, truth tables, and Boolean functions.
3. Derive normal forms (SOP, POS) and apply Quine–McCluskey method and Karnaugh maps for logic simplification.
4. Design and analyze logic diagrams and switching circuits.
5. Apply Boolean algebra to real-world applications of switching circuits.
6. Define and distinguish between undirected and directed graphs, and represent them geometrically.
7. Apply Handshaking Lemma and basic graph properties.
8. Understand and differentiate walks, trails, paths, circuits, and cycles along with their properties.
9. Identify connected, disconnected, and complete graphs, as well as graph components and complementary graphs.
10. Analyze the Ramsey problem and identify bipartite graphs.
11. Solve classical problems like the Königsberg Bridge Problem, and classify graphs as Eulerian or Hamiltonian based on their structure.
12. Find Eulerian circuits/paths and Hamiltonian cycles/paths in graphs.
13. Define and analyze trees and forests, and their basic properties.
14. Understand minimal connectivity and construct spanning trees.
15. Work with weighted graphs and apply Kruskal's algorithm to find minimum spanning trees.
16. Understand and build rooted trees and binary trees, including their structure and applications.

Group B: Differential Geometry

1. Define and analyze curves in the plane using parametric representations.
2. Compute arc length and perform reparametrization of curves.
3. Differentiate between level curves and parametrized curves.
4. Identify and work with closed curves and simple closed curves
5. Compute the curvature of plane curves and space curves.
6. Define and determine the tangent, normal, and binormal vectors, and calculate torsion of space curves.
7. Apply Frenet–Serret formulas to study the geometry of curves in space.
8. Understand and prove the isoperimetric inequality for plane curves.
9. State and apply the four-vertex theorem for simple closed curves in the plane.
10. Analyze the geometric behavior of curves using classical differential geometry results.

DS-21

MTMDSC821M

Data Science

(Credits: 5; Theory:3, Practical:2)

1. Refresh and reinforce Python programming fundamentals relevant to data analysis and scientific computing.
2. Utilize Python libraries and tools for efficient data manipulation and visualization.
3. Apply descriptive statistical methods to summarize and graphically represent data.
4. Compute and interpret summary measures and correlation metrics.
5. Develop and analyze simple and multiple regression models to explore relationships between variables.
6. Understand basic probability concepts, probability distributions, and inference techniques including hypothesis testing and parameter estimation.
7. Compute and interpret odds ratios in the context of binary outcomes.

8. Develop a binary logistic regression model with a single predictor.
9. Interpret model parameters and perform statistical inference using appropriate testing procedures tailored for logistic regression.
10. Apply descriptive statistical methods to summarize and graphically represent data.
11. Compute and interpret summary measures and correlation metrics.
12. Develop and analyze simple and multiple regression models to explore relationships between variables.
13. Understand basic probability concepts, probability distributions, and inference techniques including hypothesis testing and parameter estimation.
14. Implement and compare hierarchical clustering methods (both agglomerative and divisive) for continuous and categorical data, selecting appropriate proximity measures.
15. Apply the K-means clustering algorithm and determine the optimal number of clusters based on data characteristics.
16. Differentiate between multivariate normal populations using discrimination techniques, and estimate the probability of misclassification to assess model performance.
17. Gain a qualitative understanding of big data concepts and its challenges in data science.
18. Identify and analyze different missing value mechanisms—distinguishing between informative versus non-informative missingness with emphasis on MCAR, MAR, and MNAR frameworks.
19. Implement practical imputation strategies, including mean imputation and hot/cold deck imputation, to handle missing data in real-world datasets.

In Practical

1. Perform quantitative and graphical EDA using Python libraries (e.g., pandas, matplotlib, seaborn).
2. Identify and distinguish between data types and apply suitable visualization techniques for summarizing data.
3. Compute and interpret descriptive statistical measures (mean, median, variance, etc.) using Python.
4. Create and analyze histograms to understand the shape and spread of data distributions.
5. Visualize relationships in bivariate data using scatter plots.
6. Compute correlation coefficients and perform simple and multiple linear regression using Python tools.
7. Interpret regression results in the context of real-world applications.
8. Handle categorical variables and perform encoding where necessary.
9. Fit and interpret binary logistic regression models using Python, and derive inferences from the results.
10. Implement clustering algorithms (e.g., K-means, hierarchical clustering) on real-world datasets.
11. Apply classification techniques and evaluate model performance using appropriate metrics.

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
MTMHSE101M / MTMHSE303M
C-Programming Language
(Credits: 3)

1. Understand the purpose and structure of programming languages, including machine language and high-level languages.
2. Comprehend the compilation process and convert algorithms into machine code.
3. Develop and represent problem-solving strategies using algorithms and flowcharts.
4. Use built-in data types (int, float, double, char), constants, and variables in C programs.
5. Write simple programs using input/output functions like printf() and scanf().

6. Understand and use arithmetic operators, operator precedence, and assignment operators (including pre/post increment/decrement).
7. Apply relational operators for decision-making in programs.
8. Implement conditional statements like if, if-else, and nested if-else structures.
9. Use looping constructs: for, while, and do-while to execute repetitive tasks.
10. Control loop execution using break and continue statements.
11. Declare, initialize, and use one-dimensional arrays in programs.
12. Solve problems involving searching, sorting, and finding max/min values in arrays.
13. Understand the importance of arrays in handling structured data.
14. Understand the concept and applications of multi-dimensional arrays.
15. Perform matrix operations such as addition, multiplication, and transpose.
16. Use pointers with arrays and apply dynamic memory allocation using malloc () and free().
17. Declare, define, and call user-defined functions.
18. Understand the scope of variables: local vs global.
19. Pass arrays and pointers as function parameters.
20. Use the return statement effectively to return results.

SE-2
MTMHSE202M
Programming Language-Python
(Credits: 3)

1. Understand the history, importance, and applications of Python as a programming language.
2. Install and execute Python programs using interactive and script modes.
3. Identify and resolve different types of errors: syntax, runtime, and semantic.
4. Work with data types, variables, and expressions in Python.
5. Understand and apply operator precedence, arithmetic, and Boolean expressions.
6. Use type conversions and built-in functions like type(), input(), print(), int(), str(), float(), and id().
7. Use conditional statements: if, if-else, if-elif-else to control program flow.
8. Implement looping constructs: while, for, range(), with control statements like break and continue.
9. Define and use functions, including built-in, user-defined, and recursive functions.
10. Work with lists: indexing, slicing, list operations, and use of methods like append(), extend(), insert(), pop(), sort(), max(), min().
11. Understand the mutability of lists and the concept of aliasing.
12. Define and manipulate tuples, including nested tuples and tuple assignments.

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3
MTMHMD101T / MTMHMD201T / MTMHMD301T
Basic Mathematics
(Credits: 3)

1. Understand the fundamental concepts of sets, subsets, and perform set operations using Venn diagrams.
2. Define and analyse relations and equivalence relations.
3. Understand different types of functions (one-to-one, onto, inverse), and identify domain and co-domain.
4. Apply and analyse logarithmic, exponential, periodic, and trigonometric functions with their elementary properties.
5. Understand and compute probability of events, including conditional probability and apply Bayes' Theorem to practical problems.

6. Define and work with discrete random variables, their distributions, and compute expectation (mean) and variance.
7. Compute mean, median, mode, variance, and standard deviation for grouped and ungrouped data.
8. Understand the concept of matrices and their types, perform algebraic operations, and apply elementary row and column transformations.
9. Compute the inverse of matrices (up to 3×3) using elementary operations.
10. Calculate determinants and apply their properties; find cofactors, adjoint, and inverse of a square matrix.
11. Find the distance between two points, the slope of a line, and the angle between two lines.
12. Formulate and interpret equations of straight lines in various forms.
13. Formulate real-life optimization problems into a mathematical model of LPP.
14. Solve LPPs using the graphical method with two variables.
15. Identify the feasible region, feasible solutions, and determine the optimal solution using the corner point method.
16. Interpret the solution of LPP in practical decision-making contexts.

For UG NEP2020 syllabus of Mathematics in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2024/07/MATH_UG_NEP_SYLLABUS.pdf

Program and Course Learning outcome of Undergraduate and Post Graduate course

Department of Microbiology

BIDHANNAGAR COLLEGE

SALTLAKE

INTRODUCTION

The B.Sc. Major in Microbiology under the NEP-2020 curriculum at West Bengal State University is a rigorous three-year honours programme designed to cultivate a comprehensive understanding of microbial life and its multifarious applications across health, environment, and industry. Beginning with foundational subjects such as biomolecules, general microbiology, and cell biology, the syllabus progressively builds expertise in microbial diversity, ecology, physiology, metabolism, and microbial genetics. Emphasis is placed on practical skills—from microbial culture techniques, microscopy, staining methods, and sterilization protocols to advanced hands-on training in industrial and food microbiology, recombinant DNA technology, medical microbiology, virology, and immunology—supported by dedicated laboratory work in each semester. The curriculum seamlessly blends theoretical knowledge and experiential learning to develop analytical thinking, experimental design, and technical proficiency. Alongside discipline-specific core modules, students engage with interdisciplinary electives and skill enhancement courses to foster holistic development. On completion, graduates emerge as competent microbiologists equipped for diverse career paths in biomedical research, public health, environmental microbiology, food safety, biotechnology, pharmaceutical industries, and academic or research institutions, while also being prepared for higher studies or professional roles aligned with national and global scientific demands.

The two-year M.Sc. programme in Microbiology at Bidhannagar College, affiliated to West Bengal State University under the CBCS framework, is designed to provide advanced training in microbial sciences, blending rigorous theoretical modules with extensive practical exposure. Launched in 2004, the department is well-established with a dynamic faculty team, well-equipped laboratories featuring instruments like PCR thermal cyclers, ELISA readers, CO_2 incubators and flow cytometers. The curriculum encompasses core areas such as microbial genetics, virology, bacteriology, mycology, immunology, microbial ecology, industrial and environmental microbiology, molecular techniques, and bioprocessing—all supported by compulsory laboratory sessions, workshops, case studies, seminars, and a project/thesis component. Admission requires completion of a B.Sc. with relevant specialization and a minimum aggregate (typically ~50–55%), selected through merit and/or entrance examination. Through a mix of core, elective, and skill enhancement courses under CBCS, the programme sharpens students' analytical thinking, experimental design, and technical competencies. Graduates are well-prepared for careers in clinical/public-health labs, food and pharmaceutical industries, environmental monitoring, and academic or industrial research, and are equally equipped to pursue Ph.D. studies or competitive fellowships such as NET, GATE, or ICMR. The department's strong research orientation—backed by funded projects, postgraduate summer projects, and Ph.D. guidance—further enriches the academic experience.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOMES	
PO1:	Students acquire knowledge about the concepts in Microbiology
PO2:	Undertake hands on lab work and activities that help develop in students' practical knowledge and skills on of qualitative and quantitative analysis.
PO3:	Recognize and appreciate the importance of the microbes & Microbial Techniques. and its application in academic, industrial, economic aspects, environmental, social contexts and job aspects.

PROGRAM SPECIFIC OUTCOMES	
PSO1:	Develop a strong foundation on the basic principles of theoretical and practical microbiology.
PSO2:	Develop concepts on the fundamental principles of functioning life in the light of microorganisms
PSO3:	Understand the evolution of microbes with respect to their genomes including the pathogens and develop insights to study on culturable microbes.
PSO4:	Develop practices for safe handling of microbes and other biomolecules as well as their quantitative and qualitative enumeration.
PSO5:	Understand the distribution of microbes in the various environmental micro-niche as well as their roles in different sectors of human dwellings including food and dairy, agriculture, medicine and other industries
PSO6:	Learns how to apply microbes and microbial products in various aspects of our everyday life.
PSO7:	Get an exposure in the frontiers areas of biological research involving microbes, biomolecules and sophisticated instrumentations to handle them.
PSO8:	Acquire knowledge about applications of genetic engineering to maneuver microbes and apply them for the benefit of mankind.
PSO9:	Acquire knowledge about the different types of microbe borne diseases in both plants and animals and the defense mechanisms present to resist these challenges.
PSO10:	Integrate concepts from multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Microbiology & Biological Sciences.
PSO11:	Develop communicative skill and human values

PO-CO MAPPING

COURSES	PROGRAMME SPECIFIC OUTCOME (PSO)										
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11
DS-1	✓	✓	✓		✓						
DS-2	✓	✓	✓	✓	✓						
DS-3	✓	✓		✓			✓			✓	
DS-4	✓	✓	✓	✓	✓		✓				
DS-5	✓	✓		✓	✓	✓	✓				
DS-6	✓	✓						✓	✓	✓	
DS-7	✓	✓	✓	✓				✓	✓	✓	
DS-8	✓	✓	✓	✓	✓		✓	✓			✓
DS-9	✓	✓	✓	✓			✓	✓	✓		
DS-10	✓	✓				✓				✓	✓
DS-11	✓	✓	✓	✓		✓	✓	✓		✓	✓
DS-12	✓	✓			✓	✓	✓			✓	
DS-13	✓	✓				✓	✓		✓	✓	
DS-14	✓	✓				✓	✓	✓		✓	
DS-15	✓	✓	✓		✓	✓				✓	
DS-16	✓	✓				✓	✓	✓		✓	
DS-17	✓	✓					✓			✓	
DS-18	✓	✓					✓			✓	✓
DS-19	✓	✓					✓			✓	✓
DS-20	✓	✓				✓	✓	✓		✓	✓
DS-21	✓	✓			✓		✓	✓		✓	✓
MA-1/MB-1										✓	
MA-2/MB-2										✓	
MA-3/MB-3										✓	
SM-1/SM-2										✓	
MD-1/MD-2/MD-3										✓	
AE-1											✓
AE-2											✓
AE-3											✓
SE-1	✓	✓			✓				✓	✓	
SE-2	✓	✓		✓		✓				✓	
SE-3	✓	✓								✓	
VA-1											✓
VA-2											✓

Course Learning Outcome

MAJOR COURSES (DSC – Department Specific Course)

DSC 1

MCB DSC 101 T
Introduction to Microbiology and Microbial Diversity

- Understanding the history of development of Microbiology as a discipline and the concept of basic microbiology.
- Gaining knowledge about the diversity of microorganisms and their detailed structures and functions.
- Understanding the various scopes of microbiology

DSC 2

MCB DSC 202 T

Bacteriology

- This course throws the light on the various features of bacterial morphology, cultivation and maintenance techniques of bacteria.
- This also introduces the diversity of the bacterial and archaeal world.
- Understanding of bacterial nutrition and growth patterns, use of various different nutrients for reproduction and growth of bacteria.
- Course introduces use of different trivial and modern techniques to understand taxonomic position in bacterial systematics.
- Understanding the visualisation technique of microorganisms by magnification of small entities by applying various microscopic techniques Also introduces the modern molecular biological methods in determining bacterial systematic position.

DSC 3

MCB DSC 303 T

Biochemistry

- The student will be able to conceptualise the Structure and function of different simple and complex Carbohydrates with their stereochemistry; primary, secondary, tertiary and quaternary structure and functions of different proteins and their folding patterns; basic and advanced concept of lipid and nucleic acids, structure, functions and the mechanisms of action of enzymes.
- The student will learn kinetics of enzyme catalyzed reactions and enzyme inhibitory and regulatory process.

DSC 4

MCB DSC 404 T

Microbial Physiology & Metabolism,

- Understanding microbial growth patterns and growth variations in response to different environmental parameters, their mode of nutrition and energy acquisition.
- Conceptualize the process of nutrient uptake including important processes like group translocation and iron uptake in microorganisms.
- Comprehend heterotrophic metabolism with in depth knowledge of aerobic respiration, anaerobic respiration and fermentation.
- Basic idea on autotrophy—focusing mainly on microbial aspects. Conceptualize microbial photosynthesis.
- Ability to differentiate between chemolithotrophy and photolithotrophy and a brief idea on different chemolithotrophic.
- Understanding the important biological processes of nitrogen assimilation and nitrogen dissimilation and the crucial role played by microbes to generate nitrogen balance.

DSC 5

MCB DSC 405 T
Environmental Microbiology,

- The course content would make a student enriched with basic knowledge regarding the roles of biodiversity and ecosystem services in sustaining humans and other lives on earth and information on how both are threatened by irresponsible human activities.
- The students will be benefited by developing knowledge on: Details of air, soil, and water microbiology, Biodegradation of environmental pollutants, bioventing, bioaugmentation, biosensors, bioleaching, use of microbes to detoxify heavy metals and in oil and mineral recovery, Biomass waste management of plant's residues biotechnological applications of enzymes in various productions, liquid waste management as well as solid waste management.
- Upon completion of the course the students will understand the major concepts of environmental science, identify how toxic chemicals used for many purposes are affecting ecosystem and human health and apply the scientific method and quantitative techniques to describe, monitor and understand environmental systems

DSC 6

MCB DSC 406 T
Food & Dairy Microbiology

- Describe various intrinsic and extrinsic factors having an impact on food microbiology.
- State principles of food spoilage and different microbes associated with different categories of foods.
- Know and apply different food preservation methods for increasing shelf life of food and to prevent quality deterioration of food during storage.
- Comprehend the benefits of probiotics and the principle behind the preparation of different fermented foods and dairy products with an understanding of their beneficial aspects.
- Brief idea about packaged food technologies, food processing and food sanitary indices to minimize food intoxication and spoilage.
- Differentiate between food infection and intoxication.Isolate spoilage microorganisms from food using different selective media.
- Mention causative organisms and symptoms associated with important food borne diseases and strategies to control and minimize their occurrence.

DSC 7

MCB DSC 407 T
Medical Microbiology

- A Medical Microbiology course aims to equip students with the knowledge and skills to understand, diagnose, and manage infectious diseases. This includes understanding the biology of microorganisms, their role in causing disease, and methods for their control.
- Key outcomes include the ability to identify medically relevant microbes, interpret diagnostic tests, and apply principles of infection control and treatment.

DS8

MCB DSC 508 T
Microbial Genetics

- After completing the Microbial Genetics course, students will be able to: Handle and independently work on lab protocols involving molecular and genetic techniques.
- Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers.
- Demonstrate skill in communication of scientific data in standard format.

DS9

MCB DSC 509 T
Virology and Cancer Biology

- Knowledge and Understanding fundamentals of molecular cancer and viral biology; the structure of viruses and their genomes; virus gene expression, modes of replication and transmission, the interaction of viruses with cells and pathogenesis of virus-induced diseases, the detection, treatment, and prevention of virus infections; virus epidemiology and the genetics and evolution of viruses.

- Intellectual Skills and other Attributes understand the nature of viruses and their role in disease pathogenesis; integrate and evaluate information and data from a variety of sources.
- Knowledge on cancer tumorogenesis, oncogenes, protooncogenes, metastasis, tumor suppressor genes, and the factors causing cancer.

DS10
MCB DSC 510 T
Cell Biology

- Study of morphology and structures of cellular components.
- Different approaches of bacterial, fungal and algal Cell Structures, functions & their importance. This course is also designed to explore the fundamentals of cell biology.
- We hope learners will develop a deep intuition to understand the functional logic of a cell.
- Different advanced molecular approaches of cell division, cell cycle and regulation of cell cycle will be studied.
- To underscore the importance of cell biology in our lives, we will address questions of cellular disorders, and associated health implications in the human society.

DS11
MCB DSC 511 T
Molecular Biology

- At the end of the course, the students should be able to: Protein isolation & purification from living samples.
- Isolate and purify genomic DNA for routine laboratory procedures.
- Will be able to handle different sophisticated instruments and techniques used in recombinant DNA technology. Will be able tohandle PCR Instrument and its practical applications.
- This course has a commercial application and students can get opportunities in different R & D industries

DS12
MCB DSC 612 T
Industrial Microbiology

- Knowledge about the brief history and developments in industrial microbiology.
- Understand the suitability of microbes in industrial processes.
- Acquire knowledge of isolation of industrially important microbial strains from natural sources,strain improvement for better product formation.
- Selection and formulation of fermentation media for optimum microbial growth.
- Basic concepts of types of fermentations and different bioreactors depending on the state of the fermentation processes.
- Acquire knowledge on post fermentation recovery and purification of the desired product using different techniques. Economic aspects of fermentation processes product optimization, and Applications of the following:
  Citricacid,ethanol,penicillin,glutamicacid,VitaminB12Enzymes(amylase,protease,lipase)Wine,beer.
- Basic concept on the different methods of enzyme immobilization, their pros and cons and their industrial application.

DS13
MCB DSC 613 T
Immunology

- After completing the Immunology course, students will be able to: Understand the salient features of antigen antibody reaction &it's uses in diagnostics and various other studies.
- Learn about immunization and their preparation and its importance, demonstrate scientific quantitative skills, such as the ability to evaluate experimental design.
- Read and understand the information from scientific papers, Demonstrate skill in communication of scientific data in standard format**.**
- Understand immunological tolerance, Autoimmunity-Mechanism of different autoimmune diseases in human, hypersensitivity.
- To make aware of the students for various immunological Techniques including immunofluorescence, Immunohistochemistry, immunoprecipitation etc.

DS 14
MCB DSC 614 T
Recombinant DNA Technology

- List of different enzymes used in molecular cloning. Select suitable vectors used for cloning different sizes of gene fragments. Describe various methods to successfully deliver DNA to target cells and analyze quality of extracted biomolecules by utilizing important techniques like blotting, microarray, and SDS-PAGE.

- Describe, compare, and differentiate PCR, RT-PCR and Real-time PCR. Designing of primers and amplification of DNA fragments in thermo-cyclers.
- State the principle of traditional and automated sequencing techniques.
- Describe steps involved in genomic and cDNA library preparation and screening of the gene of interest from the library. Discuss the application of Recombinant DNA technology in therapy, in creating transgenic products,vaccines and protein engineering.
- Preparation of Competent cells and transforming cells by using pUCplasmids.

DS15
MCB DSC 615 T
Microbes in Sustainable Agriculture and Development

- The student will be able to describe the overview of soil and its characteristics and, the important microorganisms involved in mineralization of essential nutrients present in the soil and their significance in agriculture.
- Students will be able to describe various plant-microbe interactions including symbiotic and non-symbiotic associations.
- They will be able to describe various microorganisms acting as biofertilizers including bacterial, fungal and algal biofertilizers.
- Students will be able to recognize the benefits of biofertilizers as compared to chemical fertilizers in terms of increased crop productivity and mass culturing of biofertilizers. Students will be able to describe various aspects of composting.
- They will be able to discuss types and applications of bacterial and fungal biocontrol agents in agriculture and importance of organic farming.
- They will be able to describe the recycling of organic matter for an easy and cheap way to make compost to enhance soil quality.

DS16
MCB DSC 716 T
Eukaryotic Genetics

- A typical Eukaryotic Genetics course outcome includes understanding Mendelian inheritance, gene structure and expression in eukaryotes, molecular techniques, and the impact of genetics on various fields.
- Students should be able to analyze genetic data, understand the principles of inheritance, and apply this knowledge to real-world scenarios like disease and evolution.

DS17
MCB DSC 717 T
Biophysical Techniques in Research

- Students will be able to gain an understanding of the basic principles of different modern microscopy like Fluorescence, Confocal and Electron Microcopy etc.
- They will understand the principles and analyse Spectroscopy including, fluorescence, CD, ORD, NMR and ESR, also gaining insights in the applications of chromatography and electrophoresis;

.

DS18
MCB DSC 818 T
Biomathematics and Biostatistics

- Biomathematics, equips students with the skills to model and analyze biological systems using mathematical and computational techniques. Key outcomes include the ability to formulate mathematical models of biological phenomena, analyze and interpret model solutions, and apply these models to real-world biological problems.
- Students also gain proficiency in areas like population dynamics, disease modelling, and understanding complex biological systems.

- During the courses Students understand how to apply basic statistical methods in laboratory experiments of Microbiology/Biochemistry/Molecular biology.
- Learn the importance of Standard deviation, standard errors, t-test, ANOVA and other statistical methods in data representation.
- Learn how to make an experimental data statistically verified and Application of Bioinformatics in strain identification

DS19
MCB DSC 819 T
Biosafety & IPR

- To acquire knowledge about basic safety rules in Microbiology Laboratory.
- To comprehend about criteria in applying and maintaining patents.
- To be familiarized with the law and enforcement in Intellectual Property Rights.
- Developing a superior work ethics and laboratory working condition. Understanding the significance of following and maintaining laboratory safety guidelines.
- On the completion of the above objective student will be able to know about IPR and the importance of protecting their innovation.
- They will be familiar with international and national law practiced and also recent issues on it. Application of the knowledge of safety measures in laboratories

DS20
MCB DSC 820 T
Genome Biology

- A genome biology course typically aims to provide students with a comprehensive understanding of the structure, function, and evolution of genomes, as well as the technologies used to study them.
- Outcomes often include developing skills in genome analysis, understanding the dynamic nature of genomes, and applying genomic knowledge to various biological and biomedical fields.

DS21
MCB DSC 821 T
Bioinformatics

- A bioinformatics course aims to equip students with the skills to analyze biological data using computational tools, bridging the gap between biology and computer science.
- Key outcomes include understanding biological databases, sequence analysis, and phylogenetic tree construction, alongside the ability to apply statistical methods and potentially develop entrepreneurial skills.

SKILL ENHANCEMENT COURSE (SEC)

SE1
MCB SEC 101 T
Microbiological Analysis of Air and Water

- A course on Microbiological Analysis of Air and Water typically aims to equip students with the knowledge and skills to understand, detect, and analyze microbial contamination in these environments.
- Key outcomes include understanding microbial diversity in air and water, learning various sampling and detection techniques, assessing water quality, and understanding the impact of microorganisms on human health and the environment.

SE 2
MCB SEC 201 T
Food Fermentation Techniques

- Development of the concept of fermentation and fermented foods along with introduction to physicochemical changes during fermentation.
- Understanding the use of various microbes in fermentation to yield many fermented food and beverages. Throwing light on biochemical and microbiological standards and features of various starting materials like milk, cereals, vegetables etc.
- Understanding the use of meat, fish, as starting materials and analyzing the biochemical changes occurring

in the fermentation process. Introduction to quality of probiotics and probiotic potential of somespecific fermented foods.

SE 3
MCB SEC 301 T
Microbiological Diagnosis & Public Health

- Development of the concept in diagnosis of Microbes borne diseases.
- Gain the knowledge about clinical sample collection, Microscopic examination of the pathogen etc.
- Diagnosis of the Disease by advance molecular techniques.
- Theoretical Knowledge about the use of Kits for rapid detection of pathogens.

Post Graduate Program and Course Learning outcome

Courses offered

Semester 1	Semester 2	Semester 3	Semester 4
MCBT101, MCBT102, MCBT103, MCBAECC	**MCBT201, MCBT202, MCBT203, MCBSEC**	**MCBT301, MCBT302, MCBT303, MCBDSE01, MCBGEC**	**MCBT401, MCBDSE03, MCBDSE04,**

PROGRAMME OUTCOMES	
PO1:	Students acquire knowledge about the concepts in Microbiology, Molecular Biology, Recombination DNA Technology, Biostatistics, Bioinformatics, Intellectual Property Right (IPR) & Patent.
PO2:	Undertake hands on lab work and activities that help develop the experimental idea about Molecular Biology, Recombination DNA Technology, Biostatistics, Bioinformatics etc. The student acquire practical knowledge and skills on of qualitative and quantitative analysis.
PO3:	Recognize and appreciate the importance of the microbes & Microbial Techniques. and its application in academic, industrial, economic aspects, environmental, social contexts and job aspects.
PO4:	After completion of the courses they have opportunities in High end Research in various Research Institute and Universities and to get job in Microbiological & Biotechnological field. They also get opportunities in industries, Medical sectors, Parmaceutical Industries, Agricultural Sector, Processed food industries, Fermented foods, Beverage industries, Hotel Industries etc.

PROGRAM SPECIFIC OUTCOMES	
PSO1:	Holistic approach towards advanced logy and molecular microbiobiology.
PSO2:	Basic lab training.
PSO3:	Development of critical thinking.
PSO4:	Developing concept of modern biotechnology.
PSO5:	Career oriented training.
PSO6:	Detailed knowledge about diverse microbial world.
PSO7:	Application of microbiological technique in diagnostics and industries.
PSO8:	Basic training on calculation in biological field.
PSO9:	Acclimatization of student with research lab environment.
PSO10:	Develop communicative skills.

PO-CO MAPPING

Courses	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
MCBT 101	✓	✓	✓		✓		✓	✓	✓	
MCBT 102	✓	✓	✓	✓	✓	✓		✓	✓	
MCBT 103	✓	✓		✓	✓		✓	✓	✓	
MCBP 101	✓	✓	✓				✓	✓	✓	
MCBP 102	✓	✓			✓		✓		✓	
MCBAECC	✓	✓			✓				✓	✓
MCBT 201	✓	✓	✓	✓	✓		✓		✓	
MCBT 202	✓	✓	✓	✓	✓	✓	✓	✓		
MCBT 203	✓	✓	✓	✓	✓		✓	✓	✓	✓
MCBP 201	✓	✓	✓	✓	✓		✓	✓	✓	✓
MCBP 202		✓	✓	✓	✓	✓	✓	✓	✓	✓
MCBSEC	✓	✓	✓				✓	✓		
MCBT 301	✓	✓	✓	✓	✓			✓	✓	✓
MCBT 302	✓		✓	✓	✓		✓		✓	
MCBT 303	✓	✓		✓			✓		✓	✓
MCBDSE01/02	✓	✓	✓	✓		✓	✓	✓	✓	
MCBP 301	✓	✓	✓				✓		✓	
MCBP 302	✓	✓	✓	✓	✓		✓	✓	✓	
MCBGEC	✓	✓	✓			✓	✓		✓	
MCBT 401	✓	✓	✓	✓			✓		✓	
MCBDSE03/04	✓	✓	✓	✓		✓	✓		✓	
MCBP 401	✓	✓	✓	✓			✓	✓	✓	
MCBP 402	✓	✓	✓	✓	✓		✓	✓	✓	

COURSE LEARNING OUTCOME

CORE Courses

MCBT101

Biomolecules & Enzymology

Course objectives:
The objective of this course is to gain an insight into the Structure and Functions of Carbohydrates, Proteins, Lipids, Nucleic acids and a detailed discussion into the fundamentals of enzyme structure and function and kinetics of soluble and immobilized enzymes. Also it deals with current applications and future potential of enzymes.

Course outcomes:
The student will be able to conceptualise the Structure and function of different simple and complex Carbohydrates with their stereochemistry; primary, secondary, tertiary and quaternary structure and functions of different proteins and their folding patterns; basic and advanced concept of lipid and nucleic acids, structure, functions and the mechanisms of action of enzymes. The student will learn kinetics of enzyme catalyzed reactions and enzyme inhibitory and regulatory process.

MCBP101
Biomolecules and Enzymology Practical

Course objectives:
To make students aware of the principles and applications of protein estimation, Thin layer chromatography, quantitative aspects of enzyme assay

Course outcomes:
Working principle of Lowry method and Bradford method of protein estimation. Working principles of separation of amino acids and lipids by Thin Layer chromatography. Enzyme assay including effect of activators and inhibitors on enzyme activity

MCBT102
Basic Microbiology and Cell Biology

Course Objectives:

Expose students to basic concepts and principles of current microbiology. Explore techniques and tools used to study microbes and microbial diversity. Study of morphology and structures of cellular components. Different approaches of bacterial, fungal and algal classification & their importance. This course is also designed to explore the fundamentals of cell biology. We hope learners will develop a deep intuition to understand the functional logic of a cell. Different advanced molecular approaches of cell division, cell cycle and regulation of cell cycle will be studied. To underscore the importance of cell biology in our lives, we will address questions of cellular disorders, and associated health implications in the human society.

Course outcomes:

Distinguish comparative characteristics of microorganisms and their cultivation techniques. Understand the wide diversity and functions of Gram-positive and negative bacterial cells. Accumulate the knowledge of the major aims and objectives of microbial systematics. Describe processes used by microorganisms for their replication, survival, and interaction with their environment. Explain the theoretical basis of microbiological tools, technologies, and methods, Demonstrate practical skills in the use of microbiological tools, technologies, and methods and apply hypothesis testing to the design and execution of experiments. The case study helps us explore the functional logic of living systems.

MCBP102
Basic Microbiology Practical

Course objectives:
To make students aware of the principles of cultivation and microscopical examination of microbial cell. Cultivation and survival of microbes in different extreme environmental conditions.

Course outcomes:
Preparation of culture media. Cultivation of microbes. Observations of microbes under microscope. Preparation of slides, using different staining methods for microscopic observations. Isolation of microbes from soil, air and water. Microscopical and biochemical identification of microbes.

MCBT103
Biophysical Techniques

Course objectives:

To acquaint students with principles, working and applications of Microscopic techniques, spectroscopy Chromatography.

Course outcomes:

Students will be able to gain an understanding of the basic principles of different modern microscopy like Fluorescence, Confocal and Electron Microcopy etc. They will understand the principles and analyse Spectroscopy including, fluorescence, CD, ORD, NMR and ESR, also gaining insights in the applications of chromatography and electrophoresis; modern laboratory techniques like FACS, FRET, FLIP etc., along with modern concept of proteomics such as MALDI/MALDI-TOF etc.

MCBT201
Metabolism & Bioenergetics

Course objectives:
To acquaint students with an understanding of the basic metabolic pathways, inborn errors of metabolism and the application of DNA technology to their study, the control and integration of metabolism etc.

Course Outcomes:
By the end of the course the student will be able to: Describe the principles of metabolism and the differences between anabolism and catabolism; Demonstration ability to handle simple mathematical treatments of biological processes; Discuss the role of coenzymes, such as NAD+, FAD and ATP, in metabolism; Outline the metabolic pathways involving glucose, fatty acids and amino acids; Able to show, how the energy released by catabolism is recouped by substrate level and oxidative phosphorylation ; Describe the various types of genetic mutation and inborn errors of metabolism; Describe the methods for detecting and correcting inborn errors of metabolism; Outline the hormonal regulation of metabolism and discuss the role of protein phosphorylation in this context; describe the regulation pathways of metabolism; Working principle of Electron Transport Chain.

MCBP201

Molecular Biology and Recombinant DNA Technology Practical

Course Objectives:
This course will cover isolation and purification of genomic DNA, Practical aspects of recombinant DNA technology, Applications of Molecular Biological techniques in different scientific fields.

Course Outcomes:
At the end of the course, the students should be able to: Protein isolation & purification from living samples. Isolate and purify genomic DNA for routine laboratory procedures, Able to handle different sophisticated instruments and techniques used in recombinant DNA technology, Handling of PCR Instrument and its practical applications, This course has a commercial application and students can get opportunities in different R & D industries.

MCBT202
Fundamentals of Molecular Biology

Course objectives:
The course aims to equip students with a basic knowledge of the structural and functional aspects of biological macromolecules, viz., DNA, RNA and proteins. The students are able to learn the basic mechanisms replications of

biological molecules and also their regulations. Chromosomal remodelling and regulation of gene expression by modification of DNAs are also covered in these topics.

Course Outcomes:
After completion of the course, the students can apply this knowledge in their fields of research and higher education. The topics like **Regulation of Prokaryotic and Eukaryotic Genes,** Concept of quality control of gene expression and coupling of different steps of gene expression are the fundamentals of Genomics and system biology. These are the basics of future research. This course has also practical and commercial applications.

MCBP202

Environmental Microbiology Practical

Course Objectives:
This course will cover Isolation of free living N_2 fixers, heavy metal resistant bacteria from soil or water, Isolation of antimicrobial substance producing bacteria from soil, Isolation of pollutant degrading bacteria from soil, Evaluation of PGPR characteristics of rhizobacteria etc.

Course Outcomes:
At the end of the course, the students should be able to isolate Nitrogen fixers, heavy metal resistant etc and analyse their ecological significance and biochemical mechanisms behind their biodegradation ability and soil microbial processes.

MCBT203
Recombinant DNA Technology

Course Objectives:
This course will cover isolation and purification of nucleic acids, mechanisms of gene cloning, practical aspects of recombinant DNA technology, model organisms in recombinant DNA technology, recombinant gene expression systems.

Course Outcomes:
At the end of the course, the students should be able to: Isolate and purify nucleic acids for routine laboratory procedures, Explain the underlying mechanisms of gene cloning, Discuss the practical aspects of applying recombinant DNA technology, Explain the significance of model organisms in recombinant DNA technology, Describe recombinant gene expression systems, This course has a commercial applications and students can get opportunities in different R & D industries.

MCBT301
Microbial Genetics

Course Objective:
Know the terms and terminologies related to microbial genetics and understand the properties, structure and function of genes in living organisms at the molecular level, Explain the concept of recombination, linkage mapping and elucidate the gene transfer mechanisms in prokaryotes and eukaryotes.

Course Outcome:
After completing the Microbial Genetics course, students will be able to: Handle and independently work on lab protocols involving molecular and genetic techniques, Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers, Demonstrate skill in communication of scientific data in standard format.

MCBT302
Virology

Course Objectives:
The aim is to promote the knowledge and expertise in microbiology with a particular focus on virology and cancer. Students will develop an understanding of the scientific basis of established and novel cancer and virology concepts, as well as the specialist knowledge, practical skills and critical awareness required to enable students to pursue a career in virology and cancer. The specific aims/objectives are to: Provide knowledge in cancer and virology; Develop understanding of processes at the molecular level; Provide a training in laboratory and research skills;

Course outcomes:
Knowledge and Understanding fundamentals of molecular cancer and viral biology; the structure of viruses and their genomes; virus gene expression, modes of replication and transmission, the interaction of viruses with cells and pathogenesis of virus-induced diseases, the detection, treatment and prevention of virus infections; virus epidemiology and the genetics and evolution of viruses, Intellectual Skills and other Attributes understand the nature of viruses and their role in disease pathogenesis; integrate and evaluate information and data from a variety of sources; Knowledge on cancer tumorogenesis, oncogenes, protooncogenes, metastasis, tumor suppressor genes, and the factors causing cancer.

MCBT303
Immunology

Course objectives:
Demonstration and understanding of key concepts in immunology, Understand the overall organization of the immune system, Understand pharmacological basis of immunology etc.

Course outcome:
After completing the Immunology course, students will be able to: Understand the salient features of antigen antibody reaction & its uses in diagnostics and various other studies, Learn about immunization and their preparation and its importance, Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read and understand the information from scientific papers, Demonstrate skill in communication of scientific data in standard format**,** Expose students to cytokine Receptors, Cytokine Antagonists, Cytokine secretion by Th1 and Th2 subsets, Cytokine related diseases, Therapeutic uses of cytokines, cytokine storm, Understand immunological tolerance, Autoimmunity-Mechanism of different autoimmune diseases in human, hypersensitivity, To make aware of the students for various immunological Techniques including immunofluorescence, Immunohistochemistry, immunoprecipitation, DNA fiber assay, BrdU labelling.

MCBP301
Immunology & Virology Practical

Course Objective:
Student are aware of the immunological & Virological techniques and can perform the practical like ELISA, Western Blotting, Rocket Immuno-electrophoresis, Isolation of bacteriophage from water sample, Isolation of viral nucleic acid etc.

Course Outcomes:
After completing the Immunology course, students will be able to: Understand the salient features of antigen antibody reaction &its uses in diagnostics and various other studies, Learn about immunization and their preparation and its importance, Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design and get opportunities in various diagnostic, clinical laboratories and Pharmaceutical Industries as technical assistant.

MCBT401
Medical Microbiology

Course Objective:
To acquaint the students with various aspects of basic medical microbiology like Medical Diagnostic Microbiology which includes theory of pathogenesis, infectious diseases, principles of antimicrobials and their applications and modern methods of diagnostic procedures.

Course Outcome:
After completing the Medical Microbiology course, students will be able to: State the recent advances in the field of Medical Microbiology and apply this knowledge in understanding pathogenesis and diagnosis of diseases caused by micro-organisms, Carry out fundamental or applied research involving microbiological work.

MCBP401P

Bioinformatics & Biostatistics (Practical)

Course Objective: To understand fundamentals of Bioinformatics and Biostatistical methods and their application in Microbiology

Course Outcome:

During the courses Students understand how to apply basic statistical methods in laboratory experiments of Microbiology/Biochemistry/Molecular biology, Learn the importance of Standard deviation, standard errors, t-test, ANOVA and other statistical methods in data representation, How to make an experimental data statistically verified and Application of Bioinformatics in strain identification

MCBP402P
Project Work & Review Work

Students go for a project of 2 months in various Laboratories / Research Institutes to get hands on experience on various techniques and also learn to use various sophisticated instruments used in research. They get a flavor of research which motivates them to pursue doctoral program. They also join Microbiological R&D industries.

Students have to present a seminar of their project / review work and they have to appear for grand viva examination as well.

Students participate in Journal clubs where they are encouraged to read scientific articles and present their review work. They enlighten themselves on a scientific topic of their interest and its recent advancements which keeps them updated with the ever changing science and technology.

DEPARTMENT SPECIFIC ELECTIVES (DSE)

MCBDSE01
Bioprocess Technology (Theory)

Course Objective:
Get equipped with a theoretical and practical understanding of industrial microbiology, Appreciate how microbiology is applied in manufacture of industrial products, Know how to source for microorganisms of industrial importance from the environment.
Course Outcomes:
After completing the Applied Industrial Microbiology course, students will be able to: Apply various methods for their isolation, detection and identification of microorganisms in industries, Practice the theories and principles of industrial microbiology in practical, real-world situations and problems.

MCBDSE02
Industrial & Food Microbiology (Theory)

Course Objective:
Get equipped with a theoretical and practical understanding of industrial microbiology, Appreciate how microbiology is applied in manufacture of industrial products, Know how to source for microorganisms of industrial importance from the environment, Impart the basics of probiotics from different food products and their role in health benefits, Illustrate the biochemical and physiological mechanisms of probiotics, Explain the formulation and marketing of probiotics as nutritional supplements

Course Outcomes:
After completing the Applied Industrial Microbiology course, students will be able to: Apply various methods for their isolation, detection and identification of microorganisms in industries, Practice the theories and principles of industrial microbiology in practical, real-world situations and problems, Describe the fundamentals of probiotic technology and the possibility of its commercialization, Categorize the different sources of probiotics along with their uses, Assess the various beneficial bacteria and their interaction with food, Interpret the biochemical and molecular mechanisms of probiotics, Explore the various applications of probiotics in disease prevention and management, They will get opportunities to work as scientist in different food and biverages industries, Pharma industries etc.

MCBP302
Industrial & Food Microbiology Practical

Course Objective:
Student will be aware of the techniques used in food & Industrial Microbiology practical. . Isolation of pectinase, chitinase, urease producing microorganisms from natural sources. Brief knowledge about the commercial production of Suerkraut and citric acid

Course Outcomes:
After completing the Industrial & Food Microbiology course, students will be able to: Understand the salient features of isolation of microbes from soil, Learn about the production process 0f citric and Sauerkraut, Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design for industrial production, They may get opportunities in various food processing industries.

MCBDSE03
Developmental & Evolutionary Biology

Course Objective:
This course aims to provide a broad, comprehensive look at the growth and development of complex organisms, embryology with special emphasis on vertebrate models, focusing on both classical experiments and modern molecular and genetic techniques. Origin and evolution of life is also incorporated in this section

Course Outcome:

Developmental biology studies the mechanisms involved in growth and development of complex organisms. In many ways the basic understandings of developmental biology provide an invaluable foundation for other aspects of biology as well as medicine, especially as many health issues can be related back to early developmental defects during embryogenesis. This section of the course is designed to help students in understanding the ecological and effect of xenobiotics on the ecosystem. The students were also aware about the different levels of Biodiversity, threat to biodiversity and consequences of biodiversity loss.

MCBDSE04
Advance Biotechnology

Course Objective:
This course aim to provide the updated knowledge like Production of Proteins in Bacteria and Yeast, Microbial Polysaccharides and Polyesters, Metagenomics, Basic of nano-biotechnology, Transgenic technology, Plant and animal cell culture.

Course Outcome:
After completing the course, students will be able to: Learn the recent advances in the field of Microbiology, Biochemistry &Biotechnology and their applications, They can carry out fundamental or applied research involving different microbiological

SKILL ENHANCEMENT COURSE

MCBSEC
Environmental Microbiology

Course Objective:
To gain insight into the concept of air, soil, and water microbiology. To understand the Bioremediation of Environmental pollutants using microbes, To elaborate on different types of waste management.

Course Outcome:
The course content would make a student enriched with basic knowledge regarding the roles of biodiversity and ecosystem services in sustaining humans and other lives on earth and information on how both are threatened by irresponsible human activities. The students will be benefited by developing knowledge on : Details of air, soil, and water microbiology, Biodegradation of environmental pollutants, bioventing, bioaugmentation, biosensors, bioleaching, use of microbes to detoxify heavy metals and in oil and mineral recovery, Biomass waste management of plant's residues biotechnological applications of enzymes in various productions, liquid waste management as well as solid waste management, Upon completion of the course the students will understand the major concepts of environmental science, Identify how toxic chemicals used for many purposes are affecting ecosystem and human health and apply the scientific method and quantitative techniques to describe, monitor and understand environmental systems

and biotechnological aspects.

ABILITY ENHANCEMENT(COMPULSORYCOURSE)

MCBAECC
Laboratory Safety Measures & Intellectual Property Rights (IPR)

Course objectives:
To acquire knowledge about basic safety rules in Microbiology Laboratory. To comprehend about criteria in applying and maintaining patents. To be familiarized with the law and enforcement in Intellectual Property Rights. Developing a superior work ethics and laboratory working condition. Understanding the significance of following and maintaining laboratory safety guidelines

Course Outcomes:
On the completion of the above objectives student will be able to know about IPR and also the importance of protecting their innovation. They will be familiar with international and national law practiced and also recent issues on it. Application of the knowledge of safety measures in laboratories

GENERIC ELECTIVE COURSE

MCBGEC
Basic and Applied Microbiology

Course objective:

To acquire knowledge on the microbial morphology, growth characteristics, sterilization types, different diseases, and microbial culture techniques and applications of microbe in environment

Course outcome:

Students will gain knowledge about The structural aspect of bacteria and their growth pattern, Antisepsis, disinfection, sterilization, chemotherapeutic agents and bacterial drug resistance, Air water and food borne diseases, Different types of microbial culture techniques, Bioremediation, Biofertilizer, Biopesticide, food processing and fundamentals of probiotic technology and other health care products

For UG NEP2020 syllabus of Microbiology in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2025/11/Microbiology_NEP-Syllabus-New.pdf

Program and Course Learning outcome of Undergraduate course

Department of Physics

BIDHANNAGAR COLLEGE
SALT LAKE

Introduction

The outcomes-based curriculum framework for the undergraduate programs in B.Sc (Honours) in Physics is intended to provide a broad framework within which undergraduate programs in Physics help to create an academic base that responds to the need of the students to understand the basics of Physics and its ever evolving nature of applications in explaining all the observed natural phenomenon as well as predicting the future applications to the new phenomenon with a global perspective. Sustained initiatives are required for institutionalizing an outcome-oriented higher education system and enhancing employability of graduates through curriculum reform based on a learning outcomes-based curriculum framework, improving/upgrading academic resources and learning environment, raising the quality of teaching and research across all higher education institutions. The curriculum framework is designed and formulated in order to acquire and maintain standards of achievement in terms of knowledge, understanding and skills in Physics and their applications to the natural phenomenon as well as the development of scientific attitudes and values appropriate for rational reasoning, critical thinking and developing skills for problem solving and initiating research which are competitive globally and are on par in excellence with the standard Higher Education Institutions in the advanced countries of America, Asia and Europe. The outcome-based curriculum framework in Physics should also allow for the flexibility and innovation in the program design of the UG education, and its syllabi development, teaching learning process and the assessment procedures of the learning outcomes. The expected learning outcomes are used as reference points that would help formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes which in turn will help in curriculum planning and development, and in the design, delivery, and review of academic programmes.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

Program Learning Outcomes	
PO1	Acquire a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas, and applications in basic Physics
PO2	Plan and execute Physics-related experiments or investigations, analyse and interpret data/information collected using appropriate methods, including the use of appropriate software.
PO3	Appreciate and demonstrate the skills in the areas of technology and its application in academia, industrial, economic, environmental, and social context.

Program Specific Learning Outcomes	
PSO-1	**Skills in Mathematical modelling:** Recognize the importance of mathematical modelling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world
PSO-2	**Application of basic Physics concepts:** Acquire coherent understanding of the academic field of Physics to apply in different branch of physics such as Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic, Molecular Physics, etc.
PSO-3	**Procedural knowledge for professional subjects:** knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching, and government/public service
PSO-4	**Skills in related field of specialization:** Acquire skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.
PSO-5	**Ability to use in Physics problem:** Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics
PSO-6	**Develop investigative Skills:** Acquire investigative skills, including skills of independent investigation of Physics-related issues and problems
PSO-7	**Digital literacy:** Acquire digital literacy and software skills and apply it in problem solving and effective digital communication
PSO-8	**Demonstrate professional behaviour**: such as ethical issues, environmental and sustainability issues, and promoting safe learning and working environment
PSO-9	**Linkages with related disciplines:** Integrate concept from multidisciplinary subject to enhance their understanding and application
PSO-10	**Communicative Skill:** Develop communicative skills and human values

PO-CO Mapping

Courses	Program Specific Outcomes (PSO)									
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9	PSO-10
DS-1	√				√	√	√		√	
DS-2		√	√		√	√		√		
DS-3		√	√	√	√	√		√	√	
DS-4		√	√		√	√		√		
DS-5	√				√	√	√		√	
DS-6		√	√		√	√		√		
DS-7		√			√	√				
DS-8	√				√	√	√	√	√	
DS-9			√		√	√		√		√
DS-10			√	√	√	√		√		
DS-11		√	√		√	√		√		
DS-12	√	√			√	√	√	√	√	
DS-13		√			√	√	√	√		
DS-14		√	√		√	√		√		
DS-15		√	√	√	√	√	√	√		
DS-16			√	√	√	√		√	√	
DS-17	√				√	√	√	√	√	
DS-18		√			√	√			√	
DS-19			√	√	√	√		√	√	√
DS-20		√			√	√				
DS-21		√	√	√	√	√	√	√		
MA-1/MB-1									√	
MA-2/MB-2									√	
MA-3/MB-3									√	
SM-1/SM-2									√	
SEC-1			√		√	√			√	
SEC-2	√				√	√	√		√	
SEC-3									√	
MD-1/MD-2/MD-3									√	
AE-1										√
AE-2										√
AE-3										√
VA-1										√
VA-2										√

COURSE LEARNING OUTCOMES (CLO)
Major Courses (DSC-Department Specific Outcome)

DS-1

PHSDSC101T/ PHSDSC101P
Mathematical Methods-I
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Revise the knowledge of calculus, vectors, vector calculus. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.

Learn the to solve simple differential equations along with Inhomogeneous second order differential equations with constant coefficients, particular integral.

Learn the Calculus of functions of more than one variable, which have applications in various branches of Physics, especially quantum mechanics.

Lear the basic differential operators and its application and basics of line surface and volume integration and their interchangeability which forms the basics in any branch of physics.

In the laboratory course, learn the fundamentals of the Python programming languages and their applications in solving simple physical problems involving Least square fitting, Solution of Algebraic and Transcendental equations by Bisection Method, Solution of Algebraic and Transcendental equations by Newton -Raphson Method etc.

(ii) Broad contents of the course:

Calculus

Vector Calculus

Differential equations

Calculus of functions of more than one variable

Vector Integration, Green's and Stokes Theorems and their applications

(iii) Skills to be learned

Training in calculus will prepare the student to solve various mathematical problems.

He / she shall develop an understanding of how to formulate a physics problem and solve given mathematical equation risen out of it.

DS-2

PHSDSC202T/ PHSDSC202P
Mechanics-I
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

After going through the course, the student should be able to

Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. He / she will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.

Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analysing rolling with slipping.

Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.

Understand the phenomena of collisions and idea about centre of mass and laboratory frames and their correlation.

Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.

Understand simple principles of fluid flow and the equations governing fluid dynamics.

Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation.

Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.

Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.

Describe special relativistic effects and their effects on the mass and energy of a moving object.

In the laboratory course, the student shall perform experiments related to moment of inertia, elastic properties (Young Modulus and Modulus of Rigidity) and determine gravitational acceleration employing different techniques such as compound pendulum, Katers pendulum, free fall method etc along with the determination of viscosity in capillary flow method.

(ii) Broad contents of the course:

Fundamental of Dynamics

Work and Energy

Collisions

Rotational Dynamics

Elasticity

Fluid Motion

Gravitation and central force Motion

Oscillation

Non-inertial Systems

(iii) Skills to be learned

Learn basics of the kinematics and dynamics linear and rotational motion.

Learn the concepts of elastic in constant of solids and viscosity of fluids.

Develop skills to understand and solve the equations of Newtonian Gravity and central force problem.

Acquire basic knowledge of oscillation.

Learn about inertial and non-inertial systems and essentials of special theory of relativity.

DS-3

PHSDSC303T/ PHSDSC303P
Waves and Optics
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

This course will enable the student to

Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems.

Apply basic knowledge of principles and theories about the behaviour of light and the physical environment to conduct experiments.

Understand the principle of superposition of waves, so thus describe the formation of standing waves.

Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.

Use the principles of wave motion and superposition to explain the Physics of interference and diffraction.

Understand the working of selected optical instruments like biprism, interferometer, diffraction grating, and holograms.

In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, grating etc. Resolving power of optical equipment can be learnt first-hand.

The motion of coupled oscillators, study of Lissajous figures and behaviour of transverse, longitudinal waves and production and detection of standing waves through Melde's experiment can be learnt in this laboratory course.

(ii) Broad contents of the course:

Superposition of Two Collinear Harmonic Oscillations

Superposition of Two Perpendicular Harmonic Oscillations

Waves Motion – General

Velocity of Waves

Superposition of Two Harmonics Waves

Wave Optics

Interference

Michelson's and Febri-Perrot Interferometer

Diffraction

Fraunhofer Diffraction and resolving power

Fresnel Diffraction

Holography

(iii) Skills to be learned:

He / she shall develop an understanding of various aspects of harmonic oscillations and waves specially.

(i) Superposition of collinear and perpendicular harmonic oscillations

(ii) Various types of mechanical waves and their superposition.

This course in basics of optics will enable the student to understand various optical phenomena, principles, workings and applications optical instruments.

DS-4

PHSDSC404T/ PHSDSC404
Electricity and Magnetism I
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

After going through the course, the student should be able to

Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.

Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.

Apply Gauss's law of electrostatics to solve a variety of problems.

Apply method of images to solve electrostatic field problems.

Demonstrate a working understanding of capacitors.

Describe the magnetic field produced by magnetic dipoles and electric currents.

Describe how magnetism is produced and list examples where its effects are observed.

Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity,

Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.

Know about Ballistic Galvanometer, logarithmic damping, CDR for applying in various experiments.

Learn thermoelectricity with application of thermodynamics in thermoelectricity.

In the laboratory course the student will get an opportunity to verify various laws in electricity and magnetism such as Faraday's law, thermoelectricity and learn about the construction, working of various measuring instruments.

Should be able to verify of various circuit laws, network theorems elaborated above, using simple electric circuits.

(ii) Broad contents of the course:

Electric Field and Electric Potential

Conservative nature of Electrostatic Field, electric force

Electrostatic energy of system of charges

Magnetic Field and magnetic force

Electromagnetic Induction

Electrical Circuits

Network Theorems

Ballistic Galvanometer

Thermoelectricity

(iii) Skills to be learned:

This course will help in understanding basic concepts of electricity and magnetism and their applications.

Basic course in electrostatics will equips the student with required prerequisites to understand electrodynamics phenomena.

DS-5

PHSDSC405T/ PHSDSC405P
Mathematical Methods II
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Learn probability and probability distributions. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.

Learn the Fourier analysis of periodic functions and their applications in physical problems such as vibrating strings etc.

Learn about the special functions, such as the Hermite polynomial, the Legendre polynomial, the Laguerre polynomial and Bessel functions and their differential equations and their applications in various physical problems such as in quantum mechanics which they will learn in future courses in detail.

Learn the beta, gamma and the error functions and their applications in doing integrations.

Know about the basic theory of errors, their analysis, estimation with examples of simple experiments in Physics.

Acquire knowledge of methods to solve partial differential equations with the examples of important partial differential equations in Physics.

In the laboratory course, learn the basics of the Scilab software, their utility, advantages and disadvantages.

Apply the Python software for creating different arrays, and plotting ofs functions using Matplotlib, numerical differentiation and integration, verify recurrence relations either for Legendre polynomials or for Bessel functions.

(ii) Broad contents of the course:

Fourier Series

Frobenious method and Special Functions

Special Integrals

Theory of Errors

Partial Differential Equation

(iii) Skills to be learned

Training in mathematical tools like calculus, integration, series solution approach, special function will prepare the student to solve ODE, PDE's which model physical phenomena.

He / she shall develop an understanding of how to model a given physical phenomena such as pendulum motion, rocket motion, stretched string, etc., into set of ODE's, PDE's and solve them.

These skills will help in understanding the behaviour of the modelled system/s.

DS-6

PHSDSC406T/ PHSDSC406
Thermal Physics
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.

Learn about Maxwell's thermodynamic relations.

Learn the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equitation of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.

Learn about the real gas equations, Van der Waal equation of state, the Joule- Thompson effect.

In the laboratory course, the students are expected to do some basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, temperature coefficient of resistant, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.

(ii) Broad contents of the course:

Zeroth and First Law of Thermodynamics

Second Law of Thermodynamics

Entropy

Thermodynamic Potentials

Maxwell's Thermodynamic Relations

Kinetic Theory of Gases: Distribution of Velocities, Molecular Collisions, Real Gases.

(iii) Skills to be learned

This basic course in thermodynamics will enable the student to understand various thermodynamical concepts, principles.

DS-7

PHSDSC407T
Mechanics II
(Credits: 05)

(i) Course learning outcome:

Understand the concept of rotating/non-inertial frame and analyse the fictitious force such as centrifugal and Coriolis forces.

Learn the dynamics of rigid body, the moment of inertia, energy, and Euler equation for spinning symmetric top.

Learn about the small oscillation problems.

Learn the basics of fluid dynamics, streamline and turbulent flow, Reynolds's number, coefficient of viscosity and Euler equation and Navier-Stokes equation.

Learn the special theory of relativity- postulates of the special theory of relativity, Lorentz transformations on space-time.

Learn the relativistic effect on length, time, relative velocity measurement and matter-energy relationship

(ii) Broad contents of the course:

Non-Inertial Systems

Rigid Body Mechanics

Small Amplitude Oscillations

Fluid Dynamics

Special Theory of Relativity

(iii) Skills to be learned

Learn basics of the kinematics and dynamics of rotational motion

Develop the basic concepts of special theory of relativity and its applications to dynamical systems of particles

Develop and understand the basic concepts of fluid dynamics and its applications to simple problems in liquid flow.

DS-8

PHSDSC508T/ PHSDSC508P
Mathematical Methods III
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Learn about the Fourier transform, the inverse Fourier transform, three dimensional Fourier transforms with examples and their properties and their applications in physical problems.

Lear to solve boundary value problems in respect of electrostatic, heat diffusion problem etc.

Learn matrices and it different properties, eigen vectors and eigen values, matrix in solutions of Coupled Linear Ordinary Differential Equations.

In the laboratory course, the students should apply their Python programming language to solve the following problems:

Calculate the real and imaginary parts of the Fourier Transform of a real and even function

Find numerical solution of a given first order ordinary differential equation with a given initial value over a given range

Use of numpy ndarray objects for various matrix operations
Solution of linear system of equations by Gauss-Seidal iterative method and Boundary value problems.

(ii) Broad contents of the course:

Fourier Transforms, application of Fourier Transforms to differential equation.
Boundary Value Problems
Matrices, Eigenvalues, and eigenvectors

(ii) Skills to be learned

Knowledge of mathematical tools like Fourier transform will equip the student with reference to solve a given ODE, PDE.
These skills will help in understanding the behaviour of the modelled system/s.

DS-9

PHSDSC509T/ PHSDSC509P
Modern Physics I
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.

Understand the linear superposition principle and uncertainty principle and its application

Understanding the properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula.

Ability to calculate the decay rates and lifetime of radioactive decays like alpha, beta, gamma decay. Neutrinos and its properties and role in theory of beta decay.

Understand fission and fusion well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.
Gamma ray emission, energy momentum conservation: Electron positron pair creation.

Understand the spontaneous and stimulated emission of radiation, optical pumping and population inversion. Three level and four level lasers. Ruby laser and He-Ne laser in details. Basic lasing.

In the laboratory course, the students will get opportunity to perform the following experiments to have hands on experience of the Physical laws involved.

Measurement of Planck's constant by more than one method.

Determination of the charge of electron and e/m of electron.

Determination of the ionization potential of atoms.

Determine the wavelength of the emission lines in the spectrum of Hydrogen atom.

Determine the wavelength and angular spread of He-Ne Laser using plane diffraction grating.

Study diffraction phenomena in LASER.

(ii) Broad contents of the course:

Emergence of Quantum Theory, photo-electric effect, wave-particle duality, uncertainty principle and its application

Elementary introduction of nuclear physics with emphasis on

(i) Nuclear Structure

(ii) Nuclear Forces

(iii) Nuclear Decays

(iv) Fission and Fusion

Introduction to Lasers.

(iii) Skills to be learned

Comprehend the failure of classical physics and need for quantum physics.

Grasp the basic foundation of various experiments establishing the quantum physics by doing the experiments in laboratory and interpreting them.

Formulate the basic theoretical problems in one, two and three dimensional physics and solve them.

Learning to apply the basic skills developed in quantum physics to various problems in

(i) Nuclear Physics

(ii) Atomic Physics

(iii)Laser Physics

Learn to apply basic quantum physics to Ruby Laser, He-Ne Laser.

DS-10

PHSDSC510T/ PHSDSC510P
Analog Electronics
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

At the end of the course the student is expected to assimilate the following and possesses basic knowledge of the following.

Electronic Components and Measuring devices viz. DC and AC Voltmeters, Ammeters and Multimeters and their general Characteristics, Cathode-Ray Oscilloscope (CRO).

N- and P- type semiconductors, mobility, drift velocity, fabrication of P-N junctions; forward and reverse biased junctions.

Application of Zener diode for different type of rectifiers, filters and voltage regulators.

Bipolar junction transistors and basic configurations namely common base, common emitter and common collector, and also about current and voltage gain.

Field effect transistors and its characteristics

Biasing and equivalent circuits, coupled amplifiers and feedback in amplifiers and oscillators.

Operational amplifiers and knowledge about different configurations namely inverting and non-inverting

To characterize various devices namely PN junction diodes, LEDs, Zener diode, solar cells, PNP and NPN transistors. Also construct amplifiers and oscillators using discrete components. Demonstrate inverting and non-inverting amplifiers using op-amps.

(ii) Broad contents of the course:

N- and P- type semiconductors,

Fabrication of p-n junctions; forward and reverse biased junctions.

Application of P N junction

Rectifiers and voltage regulators.

NPN and PNP transistors and

Common base, common emitter and common collector

Current and voltage gain.

Biasing and equivalent circuits,

Coupled amplifiers and feedback in amplifiers and oscillators.

Operational amplifiers and its applications

(iii) Skills to be learned:

Learn basic concepts of semiconductor diodes and their applications to rectifiers.

Learn about junction transistor and their applications.

Learn about different types of amplifiers including operational amplifier. (Op-Amp) and their applications.

Learn about sinusoidal oscillators of various types.

DS-11

PHSDSC511T/ PHSDSC511P
Electricity and Magnetism II ()
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

After going through the course, the student should be able to

Apply Kirchhoff's rules to analyse AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor, and inductor.

Understand the dielectric properties, magnetic properties of materials and the phenomena of electromagnetic induction.

Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.

Understand the linear, circular, and elliptical polarisations of EM waves. Production as well as detection of waves in laboratory, uniaxial and bi-axial crystal, double refraction.

Understand propagation of EM waves in anisotropic media, phase retardation plates and their uses.

Understand the concept of optical rotation, Fresnel's Theory of optical rotation and their experimental rotation, calculation of angle rotation and specific rotation.

In the laboratory course the student will get an opportunity to have produced polarized light and detection there off using LASER and monochromatic light.

Should be able to verify of various circuit laws, network theorems elaborated above, using simple electric circuits.

(ii) Broad contents of the course:

AC Circuits, Kirchhoff's laws for AC circuits with L,C,R.

Dielectric Properties of Matter

Magnetic Properties of Matter

Electromagnetic Induction

Polarization of Electromagnetic Waves

(iii) Skills to be learned:

Learn to apply Kirchhoff's law in different network circuit.
Learn the effect of electric filed on matter
Learn the effect of magnetic field on matter
Learn the effect of electromagnetic induction and Faraday's law

DS-12

PHSDSC612T/ PHSDSC612P
Quantum Mechanics I
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

This course will enable the student to get familiar with quantum mechanics formulation
Quantum mechanics as a new framework to describe the rules of the microscopic world

The interpretation of wave function of quantum particle and probabilistic nature of its location and subtler points of quantum phenomena are exposed to the student

Quantum theory formulation is introduced through Schrodinger equation. Physical observables as Hermitian operators.

Application of quantum mechanics through problem solving, potential barrier tunnelling, potential well, degeneracy, simple harmonic oscillator.

Angular momentum, Eigenvalues, and eigenvectors.

Application of quantum mechanics for hydrogen atom and hydrogen like atom problem, space quantization-Stern Gerlac experiment.

In the laboratory course, with the exposure in computational programming in the computer lab, the student will be able to solve Schrodinger equation for ground state energy and wave functions of various simple quantum mechanical one dimensional and three-dimensional potentials.

(ii) Broad contents of the course:

Basic Formalism of Quantum Mechanics

Schrödinger equation Time dependent and Time dependent Schrodinger equation and dynamical evolution of a quantum state

Application of Quantum Mechanics in one dimension

Angular momentum, eigen vector and eigen values.

Quantum Mechanics of Hydrogenic atoms

(iii) Skills to be learned:

Lear the basic formulation of quantum mechanics

Lear to apply quantum mechanics in solving one dimensional problem of infinite potential well, potential barrier, tunnel phenomena

Lear to apply quantum mechanical formulation to find the energy eigen values and vectors for hydrogen and hydrogen like atoms.

DS-13

PHSDSC613T/ PHSDSC613P
Statistical Mechanics ()
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Understand the concepts of microstate, macrostate, ensemble, phase space, thermodynamic probability and partition function.

Understand the combinatoric studies of particles with their distinguishably or indistinguishably nature and conditions which lead to the three different distribution laws e.g., Maxwell-Boltzmann distribution, Bose-Einstein distribution and Fermi-Dirac distribution laws of particles and their derivation.

Comprehend and articulate the connection as well as dichotomy between classical statistical mechanics and quantum statistical mechanics.

Learn to apply the classical statistical mechanics to derive the law of equipartition of energy and specific heat.

Understand the Gibbs paradox, equipartition of energy and concept of negative temperature in two level system.

Learn to derive classical radiation laws of black body radiation. Wiens law, Rayleigh Jeans law, ultraviolet catastrophe.

Learn to calculate the macroscopic properties of degenerate photon gas using BE distribution law, understand Bose-Einstein condensation law and liquid Helium. Bose derivation of Plank's law

Understand the concept of Fermi energy and Fermi level, calculate the macroscopic properties of completely and strongly degenerate Fermi gas, electronic contribution to specific heat of metals.

Understand the application of F-D statistical distribution law to derive thermodynamic functions of a degenerate Fermi gas, electron gas in metals and their properties.

Understand and apply BE statistics in specific heat of solid and generate a list of microstates of n bosons distributed in N levels.

In Laboratory use Computer simulations to study:

(i) Planck's Black Body radiation Law and compare with the Wien's Law and Raleigh - Jean's Law in appropriate temperature region.

(ii) Specific Heat of Solids by comparing, Dulong-Petit, Einstein's and Debye's Laws and study their temperature dependence

Compare the following distributions as a function of temperature for various energies and the parameters of the distribution functions:

(i) Maxwell-Boltzmann distribution

(ii) Bose-Einstein distribution

(iii) Fermi-Dirac distribution

Calculate the canonical partition function of 2 bosons in three levels.

(ii) Broad contents of the course:

Classical Statistics

Classical Theory of Radiation

Quantum Theory of Radiation

Bose-Einstein Statistics and its Applications

Fermi-Dirac Statistics and its Applications.

(iii) Skills to be learned

Learn the basic concepts and definition of physical quantities in classical statistics and classical distribution law.

Learn the application of classical statistics to theory of radiation.

Comprehend the failure of classical statistics and need for quantum statistics.

Learn the application of quantum statistics to derive and understand.

(i)Bose Einstein statistics and its applications to radiation.

(ii) Fermi-Dirac statistic and its applications to quantum systems.

DS-14

PHSDSC614T
Electricity and Magnetism III
(Credits: 05)

(i) Course learning outcome:

As the successful completion of the course the student is expected to be conversant with the following

Review Maxwell' s equations and understand Physical Concept of Electromagnetic Field Energy.

Understand the concept and physics behind the plane EM waves propagation through vacuum and isotropic dielectric medium.

Understand the concept and physics behind the plane EM waves propagation through bounded Media

Understand the concept of electromagnetic dispersion and dipole radiation

Understand the concept of wave guide and field energy and power transmission

(ii) Broad contents of the course:

Electrodynamics

EM Wave Propagation in Unbounded Media

EM Wave Propagation in bounded Media

Dispersion

Electromagnetic Radiation and Wave guides

(iii) Skills to be learned

This course will help in understanding basic concepts of electromagnetic wave propagation and their applications.

This course in electricity and magnetism will equips the student with the understanding of dispersive and radiation to correlate with nature.

DS-15

PHSDSC615T/ PHSDSC615P
DIGITAL SYSTEMS AND APPLICATIONS
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

As the successful completion of the course the student is expected to be conversant with the following.

Secure first-hand idea of different components including both active and passive components to gain a insight into circuits using discrete components and also to learn about integrated circuits.

About analogue systems and digital systems and their differences, fundamental logic gates AND, OR, NOT, combinational as well as sequential and number systems.

Synthesis of Boolean functions, simplification, and construction of digital circuits by employing Boolean algebra.

Arithmetic circuits and Basic idea of Multiplexers

Sequential systems by choosing Flip-flop as a building bock- construct multivibrators, counters to provide a basic idea about memory including RAM, ROM, 555 ICs and about memory organization.

In the laboratory he is expected to construct both combinational circuits and sequential circuits by employing NAND as building blocks and demonstrate Adders, Subtractors, Shift Registers, and multivibrators using 555 ICs.

(ii) Broad contents of the course:

Active and passive filters

Fundamental logic gates, combinational as well as sequential and number systems.

Synthesis of Boolean functions, simplification, and construction of digital circuits by employing Boolean algebra.

Sequential systems by choosing Flip Flop as a building bock- construct multivibrators, counters to provide a basic idea about memory including RAM, ROM and about memory organization.

Registers, Counters and basics of Computer Organization

(iii) Skills to be learned

Acquire skills to understanding the functioning and operation of CRO to measure physical quantities in electrical and electronic circuits.

Learn the basics of IC and digital circuits, and difference between analog and digital circuits. Various logic GATES and their realization using diodes and transmitters.

Learn fundamental of Boolean algebra and their role in constructing digital circuits.

Learn about combinatorial and sequential systems by building block circuits to construct multivibrators and counters.

DS-16

PHSDSC716T/ PHSDSC716P
Solid State Physics
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

At the end of the course the student is expected to learn and assimilate the following.

A brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.

Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.

Acquire knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss.

Free electron theory of metals, conductivity, and Hall effect.

Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.

Understand the basic idea about superconductors and their classifications.

To carry out experiments based on the theory that they have learned to measure the magnetic susceptibility, trace hysteresis loop. They will also employ to four probe methods to measure electrical conductivity and the hall set up to determine the hall coefficient of a semiconductor.

(ii) Broad contents of the course:

Crystalline and amorphous substances, lattice, unit cell, miller indices, reciprocal lattice. Brillouin zones and diffraction of X-rays by crystalline materials.

Lattice vibrations and phonons

Different types of magnetism

Free electron theory of Metals

Band theory of solids

Insulators, conductors and semiconductors.

Superconductors and their classifications.

(iii) Skills to be learned

Learn basics of crystal structure and physics of lattice dynamics

Learn the physics of different types of material like magnetic materials, dielectric materials, metals and their properties.

Understand the physics of insulators, semiconductor and conductors with special emphasis on the elementary band theory of semiconductors.

Comprehend the basic theory of superconductors. Type I and II superconductors, their properties and physical concept of BCS theory.

DS-17

PHSDSC717T/ PHSDSC717P
Mathematical Methods IV
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Learn about the complex numbers and their properties, functions of complex numbers and their properties such as analyticity, poles, and residues. The students are expected to learn the residue theorem and its applications in evaluating definite and improper integrals.

Learn Binary Operators, Groups and Fields. The students are expected to learn Linear Transformations and Algebra of Linear Transformations.

Learn the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.

Learn the concept of covariant and contravariant vectors and basics of Tensors.

In the laboratory course, the students should apply their Python programming language to solve the following problems:

Find the Cube roots of a complex number
Calculate the roots by De Moivre's formula
Find complex roots of an arbitrary algebraic equation
Evaluate the improper integral
Apply Gram Schimdt orthogonalization.
Eigenvalue and eigenvector calculation by Jacobi Method

(ii) Broad contents of the course:

Complex Variables
Linear Vector Space

Vectors in curvilinear coordinates and Tensors

(iii) Skills to be learned

Knowledge of complex variables will equip the student with reference to solve definite and improper integrals.

With knowledge of Curvilinear Co-ordinates, the students will learn the skills to transform co-ordinates and generalise the different operators in general forms.

DS-18

PHSDSC818T
Application of Quantum Mechanics
(Credits: 05)

(i) Course learning outcome:

At the end of the course the student is expected to learn the application of Quantum mechanics studied so far in the previous courses

Time dependent and time independent perturbation theory.

Apply variational method to solve the problem of simple harmonic oscillator and hydrogen atom.

Space quantization, angular momentum, electronic configuration of atoms.

Zeeman Effect, Paschen Back effect, Spin-orbit coupling in atoms - L-S and J-J coupling schemes of atoms.

Basics of Molecular Spectroscopy such as rotational, vibrational and Raman spectroscopy.

(ii) Broad contents of the course:

Approximate methods for stationary states: Time independent and time dependent perturbation theory

Method of variation and Variational Theorem

Elements of Atomic Physics

Basics of Molecular Spectroscopy

(iii) Skills to be learned

Develop skill to apply the theoretical knowledge of quantum mechanics to stationary states in the form of approximation method.

Application of quantum theory to find the ground state energy of hydrogen and hydrogen like atoms helium ion and hydrogen molecular ion.

Skill to apply quantum mechanics to investigate the origin of atomic and molecular spectroscopy.

DS-19

PHSDSC819T
Nuclear and Particle Physics
(Credits: 05)

(i) Course learning outcome:

Learn the ground state properties of a nucleus – the constituents and their properties, mass number and atomic number, relation between the mass number and the radius and the mass number, average density, range of force, saturation property, stability curve, the concepts of packing fraction and binding energy, binding energy per nucleon vs. mass number graph, explanation of fusion and fission from the nature of the binding energy graph.

Know about the nuclear models and their roles in explaining the ground state properties of the nucleus –(i) the liquid drop model, its justification so far as the nuclear properties are concerned, the semi-empirical mass formula, condition of nuclear stability (ii) the shell model, evidence of shell structure, magic numbers, predictions of ground state spin and parity, theoretical deduction of the shell structure, consistency of the shell structure with the Pauli exclusion principles.

Learn about the process of radioactivity, the radioactive decay law, the emission of alpha, beta and gamma rays, the properties of the constituents of these rays and the mechanisms of the emissions of these rays, outlines of Gamow's theory of alpha decay and Pauli's theory of beta decay with the neutrino hypothesis, the electron capture, the fine structure of alpha particle spectrum, Mossbauer spectroscopy, internal conversion.

Learn the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws, The reaction cross-sections, the types of nuclear reactions, direct and compound nuclear reactions, Rutherford scattering by Coulomb potential.

Learn some basic aspects of interaction of nuclear radiation with matter- interaction of gamma ray by photoelectric effect, Compton scattering and pair production, energy loss due to ionization, Cerenkov radiation.

Learn about the detectors of nuclear radiations- the Geiger-Mueller counter, the scintillation counter, the photo-multiplier tube, the solid state and semiconductor detectors.

The students are expected to learn about the principles and basic constructions of particle accelerators such as the Van-de-Graff generator, cyclotron, betatron and synchrotron. They should know about the accelerator facilities in India.

Gain knowledge on the basic aspects of particle Physics – the fundamental interactions, elementary and composite particles, the classifications of particles: leptons, hadrons (baryons and mesons), quarks, gauge bosons. The students should know about the quantum numbers of particles: energy, linear momentum, angular momentum, isospin, electric charge, colour charge, strangeness, lepton numbers, baryon number and the conservation laws associated with them.

(ii) Broad contents of the course:

General properties of nuclei

Nuclear models

Radioactive decays

Nuclear reactions

Interaction of nuclear radiation with matter

Detectors for nuclear interaction

Particle accelerators

Elementary particles and their properties

(iii) Skills to be learned

Skills to describe and explain the properties of nuclei and derive them from various models of nuclear structure.

To understand, explain and derive the various theoretical formulation of nuclear disintegration like α decay, β decay and decays.

Develop basic understanding of nuclear reactions and decays with help of theoretical formulate and laboratory experiments.

Skills to develop basic understanding of the interaction of various nuclear radiation with matter in low and high energy.

Ability to understand, construct and operate simple detector systems for nuclear radiation and training to work with various types of nuclear accelerators.

Develop basic knowledge of elementary particles as fundamental constituent of matter, their properties, conservation laws during their interactions with matter.

DS-20

PHSDSC820T
Mechanics III
(Credits: 05)

(i) Course learning outcome:

Revise the knowledge of the Newtonian, the Lagrangian and the Hamiltonian formulations of classical mechanics and their applications in appropriate physical problems.

Learn how symmetry leads to conservation principles.

Learn dynamical systems and its stability analysis of one-dimensional autonomous system.

Learn Nullclines and its use for oscillation and sketching of flows and trajectories in phase space.

Learn nonlinear dynamics of oscillators, Vander-Pol oscillator.

Learn idea of chaos and fractal and fractal dimension.

(ii) Broad contents of the course:

Lagrangian Dynamics

Symmetries and Conservation principle

Hamiltonian dynamics

Dynamical Systems: Autonomous and non-autonomous systems

Nonlinear Dynamics

(iii) Skills to be learned

Learn to define generalised coordinates, generalised velocities, generalised force and write Lagrangian for mechanical system in terms of generalised coordinates.

Learn to write Hamiltonian for mechanical systems and derive and solve Hamilton's equation of motion for simple mechanical systems.

Acquire skill to do Linear stability analysis for different mechanical system

Nullclines and flows from nullclines for illustrations for a particle under uniform gravity, harmonic oscillator.

Acquire skill to describe nonlinear dynamical system through iterative and logistic map.

DS-21

PHSDSC821T/ PHSDSC821P
COMMUNICATION ELECTRONICS
(Credits: 05; Theory-03, Practicals-02)

(i) Course learning outcome:

At the end of the course the student is expected to have an idea/concept of the following,

Electromagnetic spectra and different frequency bands and frequency allocation for radio communication system in India (TRAI).

Modulation, different types of modulation and about super heterodyne receivers.

Concept of sampling, sampling theorem and multiplexing.

Digital transmission, encoding and decoding.

Satellite communication including up linking and downlinking.

Mobile communication/telephony and concepts of cell telephony.

2G, 3G, 4G (Qualitative).

Apply the theory that they have learned in the theory class to gain hands on experience in building modulation and demodulation circuits; Transmitters and Receivers for AM and FM. Also to construct TDM, PAM, PWM, PPM and ASK, PSK and FSK modulator and verify their results.

(ii) Broad contents of the course:

Electromagnetic spectra and different frequency bands.

Modulation, different types of modulation and super heterodyne receivers.

Sampling, sampling theorem and multiplexing.

Digital transmission, encoding and decoding.

Satellite communication

Mobile communication/telephony and concepts of cell telephony.

2G, 3G, 4G and 5G (Quantitative).

(iii) Skills to be learned:

Learn the skills to understand the basic concepts of communication.

Learn the techniques of different types of modulation of electromagnetic signals like

(i) Amplitude Modulation

(ii) Frequency Modulation

(iii) Phase Modulation

(iv) Analog Pulse Modulation

(v) Digital Pulse Modulation

Learn basics of satellite communication.

Learn concepts and application of mobile telephony system.

SKILL ENHANCEMENT COURSES (SEC)

SE-1/SE-3

PHSHSE101M/PHSMSE101M
Basic Instrumentation Skills
(Credits: 03)

(i) Course learning outcome:

After the successful completion of the course the student is expected to have the necessary working knowledge on accuracy, precision, resolution, range and errors/uncertainty in measurements. He/she will acquire hands on skills in the usage of oscilloscopes, mustimeters, multivibrators, rectifiers, amplifiers, oscillators, and high voltage probes. He also would have gained knowledge on the working and operations of LCR Bridge, generators, digital meters and counters.

(ii) Broad contents of the course:

Basics of measurement

Electronic voltmeters/Multimeter

Cathode ray oscilloscope

Signal generators.

Digital instruments, Digital Multimeter

(iii) Skills to be learned

Develop skills to use basic electrical instruments like Multimeter, electronic voltmeter, cathode ray, and oscilloscope.

Acquire efficiency in making signal generators and analysis of obtained signals.

Learn to understand and use various types of digital instruments.

Develop knowledge of Signal generators.

SE-2

PHSHSE202M
Computational Physics Skills
(Credits: 03)

(i) Course learning outcome:

Learn the importance of computers in solving problems in Physics.

Learn how to plan for writing the algorithm for solving a problem by drawing the flowchart of simple problems like roots of quadratic equations etc.

Have a working knowledge about the Linux system, for example, the necessary commands.

Learn, write, and run FORTRAN/C++ programs in the Linux system. They should attempt the following exercises:

(i) Exercises on syntax on usage of FORTRAN.

(ii) Usage of GUI windows, Linux commands, familiarity with DOS commands and working in an editor to write sources codes.

(iii) To print out all natural even/ odd numbers between given limits.

(iv) To find maximum, minimum and range of a given set of numbers.

The students should also learn "Scientific Word Processing", particularly, how to use the LaTeX software in writing articles and papers which include mathematical equations and diagrams. Similarly, students should learn the basics of Gnu plot.

To have hands-on experience on computational tools, students are expected to do the following exercises:

(i) to compile a frequency distribution and evaluate mean, standard deviation etc,

(ii) to evaluate sum of finite series and the area under a curve,

(iii) to find the product of two matrices

(iv) to find a set of prime numbers and Fibonacci series,

(v) to write program to open a file and generate data for plotting using Gnu plot,

(vi) plotting trajectory of a projectile projected horizontally,

(vii) plotting trajectory of a projectile projected making an angle with the horizontal direction,

(viii) creating an input Gnu plot file for plotting a data and saving the output for seeing on the screen, saving it as an eps file and as a pdf file,

(ix) to find the roots of a quadratic equation,

(x) numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization,

(xi) Simulate the motion of a particle in a central force field and plot the output for visualization.

(ii) Broad contents of the course:

Introduction

Scientific Programming

Control Statements

Scientific word processing: Introduction to LATEX

Visualization

(iii) Skills to be learned

The students should learn the skills for writing a flow chart and then writing the corresponding program for a specific problem using the C^{++}/FORTRAN language.

The student should also acquire the proficiency in effectively using the GUI Windows, the LINUX operating system and also in using the LaTeX software for wring a text file.

MULTIDISCIPLINARY COURSES (MDC)

MD-1/MD-2/MD-3

PHSHMD101M/PHSHMD201M/PHSHMD301M
Current perspectives of Physics
(Credits: 03)

(i) Course learning outcome:

The course gives an overview of some basic physical ideas at a semi-popular level – with minimal use of mathematics.

They will gain a Qualitative idea of Systems, Observers, Reference frames and Forces originating from the fundamental Interactions of nature.

They will learn how laws are discovered from observation with example of

- Galilean and Newtonian Dynamics giving Laws of motion
- Kepler's law explained by Newton's law of gravity
- Empirical law of electromagnetism
- From black body radiation to origination of concept of 'quanta'.

They will have a qualitative idea of how the the fundamental constants, velocity of light (c), Gravitational constant (G) and Planks constant ($h/\hbar$) play significant role in different region of velocity and/or size.

Learn the nature of light and about electromagnetic spectrum and its use for different purpose at different region.

(ii) Broad contents of the course:

Qualitative idea of Systems, Observers, Reference frames and Forces

Demonstration of how Physics works in observations that lead to discovery of different Laws of nature like gravity, electromagnetism etc.

Role of universal constant such as velocity of light (c), Plank's constant (h/ħ), gravitational constant (G) in nature.

Light and it's dual nature and The Electromagnetic Spectrum

(iii) Skills to be learned

Aquire the skill to overview some basic physical ideas at a semi-popular level – with minimal use of mathematics

For UG NEP2020 syllabus of Physics in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2024/12/NEP_Physics_4_year_syllabus.pdf

★ ★ ★

Program and Course Learning outcome of Undergraduate course

Department of Political Science

BIDHANNAGAR COLLEGE

SALTLAKE

INTRODUCTION

The B.A. Major program in Political Science under the NEP 2020 framework at West Bengal State University is an innovative and rigorous four-year Honours program that combines comprehensive theoretical exploration with practical skill development. Aligned with NEP's emphasis on interdisciplinary and experiential learning, the curriculum covers foundational and advanced topics including Understanding Politics, Western Political Thought, Ancient and Modern Indian Political Thought, Comparative Government and Politics, International Relations, Political Theory, Public Administration and Public Policy, Administration in India, Global Politics, and studies of various Constitutions across the world. Students of Major programmes in other disciplines also engage in Minor courses like Political Theory and Comparative Politics, Multidisciplinary elective courses, such as Gender and Politics and as well as Skill Enhancement Courses like Democratic Awareness and Legal Literacy. The program also integrates internships, field visits, seminars, and project-based assignments to foster analytical reasoning, democratic awareness, digital literacyand ethical citizenship. Guided by experienced faculty, learners delve into constitutional processes, state institutions, international system, global issues and political ideologies—ranging from classical Western philosophies to contemporary Indian thought—while developing strong research and communication capabilities. This well-rounded, learner-centric program not only prepares graduates for diverse career pathways in civil services, diplomacy, journalism, public policy, academia, and non-governmental sectors but also cultivates socially conscious, critically minded, and globally aware citizens.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOME	
PO 1	**Philosophical & Conceptual Understanding:** Learn, explore and critically examine the philosophical, conceptual and theoretical dimensions as the founding base for a comprehensive grasp on the discipline.
PO 2	**Critical Thinking & Problem Solving:** Develop the ability and skills to take informed action after identifying concepts and analysing situations at hand, examining the degree to which these are accurate and valid and evaluating perceptions and decisions (intellectual, organizational and personal) from different perspectives, thereby converting theoretical knowledge to practical application
PO 3	**Social Interaction & Effective Communication:** Acquire the ability and interactive skills to elicit ideas and views of others in the broad social set up in activities like field work, survey etc and develop the abilities to articulate and express, thereby connecting people, ideas and concepts going beyond the traditional textbook based teaching -learning process.
PO 4	**Effective Citizenship & Ethical Orientation:** Develop and demonstrate empathetic social concern, recognize different value systems. develop multicultural aptitude, tolerant spirit and contribute towards a sustainable all-round, equity centered development along with the ability to act with an informed awareness of rights, duties, issues and participate in civic life through volunteering.
PO 5	**Interdisciplinary & Research Orientation:** Gain the perspective that politics as an activity as well as academic pursuit occurs within the society and economy and wholesome understanding requires an interdisciplinary approach in coordination with History, Sociology, Economics, Philosophy etc and staying updated on developments (conceptual and practical) along with exploration and application of new contours of learning.

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Develop a clear understanding of the key methodological, conceptual-theoretical and empirical issues in politics and the ability to appraise and assess the main areas of debate in the complex and fragmented world of Political Science thereby promoting critical thinking.
PSO 2	Develop an understanding of the Indian Constitution and ability to appraise and identify the structural questions of how the various institutions of the modern Indian state took shape and critically analyse the functioning of such institutions since independence in the evolving socio-economic-political environment, thereby setting the foundations of effective citizenship.
PSO 3	Enable learners to gain knowledge about the constitutional processes and political systems of different countries of the world like USA, UK, China etc and thereby promoting development of critical thinking abilities to categorize, compare and analyse the functioning of different political systems across the world.
PSO 4	Develop skills to identify, assess, interpret, internalize and compare various strands of Indian & Western political thought right from ancient times to the present thereby noting convergences and divergences in such thoughts and also recognise the links between thought and praxis.
PSO 5	Develop knowledge about International Relations both as a theoretical discipline and enabling learners to identify and assess the intricacies of global politics along with its actors and institutions as it plays out all over the world today.
PSO 6	Enable learners to assess India's International Relations and her policies at the bilateral, regional and global levels and develop abilities to critically appraise the role she plays in global and regional multilateral bodies like UN, WTO, IMF, World Bank etc.

PSO 7	Acquaint learners with the interdisciplinary nature of the subject matter of Political Science (for instance, it's interaction with Sociology) and equip them with knowledge and skills to identify and critically examine various themes and issues that establish the relationship between society and politics like political culture, socialisation, caste, class, elites, gender, religion etc.
PSO 8	Learn the use of various social research tools and statistical methods related to surveys and thereby develop skills for analysis like voting behaviour, poll predictions etc thereby promoting research and social interaction skills.
PSO 9	Enable learners identify the 'actual' and 'practical' workings of government using conceptual-theoretical tools and critically appraise administration, its role in formulation of public policy, implementation, problems available, public policy choices and inter-relationship between policy decisions and its reflection on society.
PSO 10	Develop knowledge and awareness regarding rights, duties, social movements, laws & legal systems etc thereby developing base for inculcating effective citizen qualities and development of skills to apply such knowledge to promote productive social interactions and coordinated actions towards positive change.
PSO 11	Acquire active interdisciplinary mindset and the ability of using conceptual knowledge to engage in independent and life-long learning and analysis of evolving issues in the broad socio-economic-political context.
PSO 12	Develop communicative skill and human values.

Mapping of PO-CO

PSO / Courses	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
DS1	✓						✓			✓		
DS2		✓										✓
DS3	✓						✓					
DS4		✓						✓		✓		
DS5	✓		✓					✓				
DS6	✓				✓	✓						
DS7	✓								✓			
DS8									✓		✓	
DS9					✓	✓						
DS10				✓								
DS11				✓								
DS12							✓					✓
DS13							✓					
DS14				✓								
DS15				✓								
DS16								✓				
DS17	✓											
DS18					✓	✓						
DS19									✓			
DS20												✓
DS21											✓	
MA-1/MB-1											✓	
MA-2/MB-2											✓	
MA-3/MB-3											✓	
SM1/SM2											✓	
SE-1											✓	
SE-2								✓				
SE-3											✓	
AE1												✓
AE2												✓
AE-3												✓
MD-1/MD-2/MD-3											✓	
VA-1												✓
VA-2												✓

Course Learning Outcome

MAJOR COURSES (DSC – Department Specific Course)

DS 1
(PLSDSC101T)
Political Theory: Concepts
(Credit: 5)

This course is designed to develop a foundational understanding of Political Science. The first step towards learning any discipline is developing a theoretical understanding of the subject matter. The course contents shed critical light upon key political concepts and their different meanings, interpretations, and theoretical positions.

After completing this course, the students are expected to,

- develop conceptual understanding of some foundational ideas of the discipline.
- explain different approaches to politics and build their own understanding of politics.
- gain knowledge and assess the role and functions of political theory.
- develop abilities to answer why the state plays occupies a central place in the discourses on politics and make crucial conceptual distinctions for instance, between nation and state.
- learn about power and how operates in society and politics.
- be acquainted with the contemporary debates on key concepts like equality, freedom, democracy, citizenship, and justice, thereby developing a critical understanding of the expanding horizons of discourses in the discipline.

DS 2
(PLSDSC202T)
Indian Constitution and Government
(Credit: 5)

Effective, aware and active citizenship requires a working knowledge of the political system to which one belongs along with a clear understanding of one's rights and duties as a citizen. Working of a political system depends on constitutional and extra-constitutional institutions along with forces that shape the functioning of the government and political system. This paper exposes the students to the formal-structural, constitutional side by providing a clear idea of the basics of the Constitution of India by picking some fundamental themes and core institutions which are essential to understand the core philosophy and the ideals of Indian constitution, the functioning of the government apart from the framework in which the polity operates.

After completing this course, the students are expected to,

- gain objective knowledge about constitutionalism in the Indian context through the function of the various organs of the government and their interrelationships.
- know the evolution of Indian Constitution and internalize its core philosophy and ideals as enshrined in the Preamble.
- develop awareness on Fundamental Rights, how these rights are different from the Directive Principles of the State Policy and their duties as citizens of the country.
- have the knowledge and ability to explain the structures, powers, and functions of three organs of government and their mutual relationship and engagements.
- assess and analyse the federal structure of the Indian government and the emerging trends in centre-state relations as part of everyday politics.

Apart from building aware future citizens of the country, this course also aims at preparing the learners for a career in academics, legal professions, administrative services, media and various civil society organisations.

DS 3
(PLSDSC303T)
Political Theory: Approaches
(Credit: 5)

The course has been designed to introduce the key political approaches to the students to enrich their understanding of political discourses. Diverse traditions and approaches have been included in the teaching scheme to make understanding comprehensive and insightful.

After completing this course, the students are expected to,

- develop conceptual understanding of some foundational approaches of the discipline.
- learn about certain dominant ideologies like idealism, liberalism etc
- gain in depth knowledge of the Marxist approach to politics with all its major components.

Such a course can develop cognitive abilities of the students thereby shaping their critical- analytical worldview by informing ideas, beliefs, opinions etc.

DS 4
(PLSDSC404T)
Politics in India: Structures and Processes
(Credit: 5)

The objective of the course is to familiarise the students with the political processes of India and enable them to critically assess the same. This course provides students a solid grounding in Indian politics where they study the extra-constitutional institutions, factors, and forces which influence the political discourses and decisions in the country**.** As politics operates in an ecology constituted by the constitutional, socio-economic, linguistic and ethnic sub-systems, the course is designed to understand their roles in the politics of the country.

After completing this course, the students are expected to,

- develop the ability to explain and analyse the ideology, structure,social base and functioning of the key political partiesplaying the pivotal role in the democratic polity of India and also gain insights into transition from one party dominant system to coalition politics over the years.
- gain an idea of the electoral process in India.
- critically examine the role of various drivers of Indian identity politics like caste, tribe, religion, language etc.
- develop ideas regarding role of various classes like working class, peasants etc. in Indian politics and how their actions have shaped political agenda across decades.
- critically analyse the various movements related to women, environment and human rights that have shaped the political scenario as we see today.
- Critically assess the role of media as the fourth pillar of Indian democracy.

Such a course is thus expected to create aware and conscious citizens who have the conceptual understanding and ability to critically analyse and interpret evolving issues around them thereby fulfilling the criteria of lifelong learning.

DS 5
(PLSDSC405T)
Comparative Government and Politics
(Credit: 5)

Comparison is crucial for explanation and analysis and is also a natural human instinct. Our understanding of 'self' is conditioned to a great extent in relation to an 'other'. Drawing on this perspective, the objective of the course is to make the students comparatively understand and assess the constitutional structures and political processes of different types of states around the world. Also, a political system does not operate in vacuum but within a legal, economic, socio-political and cultural ambience. This course exposes the students to understand concepts and approaches which can be applied for understanding different political regimes in terms of governmental structures and their functioningin their context thereby enabling contextual comparison as well.

After completing this course, the students are expected to,

- develop an idea of comparative politics and its nature, scope and tools of comparison.
- learn about different types of political systems and their characteristic features.
- critically understand and compare the structure and functions of the organs of government of various countries like UK, USA, PRC, France.
- develop a comprehensive understanding of different types of regimes thereby sharpening skills and aptitude for research.

DS 6
(PLSDSC406T)
International Relations: Theory and Approaches
(Credit: 5)

This paper seeks to equip students with the basic intellectual tools for understanding International Relations (IR). The key objective of this course is to introduce the students to the mainstream International Relations (IR) approaches such as realism and critical approaches such as feminism. This course is also expected to act as a catalyst for students to think creatively and critically in search of ‘global’ or more ‘international’ in international relations that is inclusive of non-western experiences, traditions and interactions and critical of the western domination and euro-centric bias of mainstream IR and its neglect of the history, politics and contributions made by non-western traditions of thought and theory. The course also emphasizes the diversity of actors in the global scenario apart from the states and hence includes activities of international organizations like United Nations and its specialized agencies along with regional organizations like SAARC etc thereby providing the students a comprehensive view of the dynamics of global politics.

After completing this course, the students are expected to,

- Understand the key assumptions and arguments of the various mainstream and critical theoretical positions in IR.
- Know and apply the key concepts of the domain of IR while explaining and analysing the international and global scenario.
- appreciate global IR and why non-western perspectives countering ethnocentrism are needed along w public policies ith the role played by non -Western countries in building norms in various key areas of global politics.
- develop abilities to explain and critically assess roles of international and regional organizations along with the politics being played therein regarding agenda and functioning.

DS 7
(PLSDSC407T)
Public Administration: Theory and Concepts
(Credit: 5)

This course seeks to familiarise the students with the meaning, nature, scope and evolution of the discipline of Public Administration. Apart from emphasising the key concepts, the course also sheds light upon the various theoretical perspectives. The course deals with the structure and functioning of the organization and seeks to develop understanding in students the need to study public administration and how to make the functioning of their working far more economic and efficient which are common goals of all the organizations. Further, the dynamics of the functioning of organizations lead us to think about communication, motivation, leadership and conflict management in the organization. This course will allow the students to understand and examine how different schools have responded to these questions and what are their limitations.

After completing this course, the students are expected to,

- understand the concept of public administration and differentiate between public administration and private administration.
- learn the various theories ranging from classical to contemporary and critical positions and develop ability to explain the journey of discourse in public administration in the sense that how the old public administration view was contested by the idea of new public administration and subsequently the discourse moved beyond that to those of New Public Management and New Public Service.
- know and explain various concepts related to administration and processes like decision making, communication, leadership, coordination etc.
- critically examine and analyse the changing nature of public administration in the era of globalization and privatization as well as gain ideas regarding public-private partnership in the Indian context.

DS 8
(PLSDSC508T)
Public Administration and Public Policies in India
(Credit: 5)

This course aims to introduce students to the Indian perspective of public administration. This will help them develop an understanding of how different administrative institutions in India evolve and function. It has been designed to provide students with an idea of different and crucial social welfare policies in India.

After completing this course, the students are expected to,

- Understand the concept of public policies and differentiate between public administration and public policies.
- Know the concept of bureaucracy and its functioning in India.
- Know the different administrative institutions in India.
- Understand the concept of Budget in India

DS 9
(PLSDSC509T)
International Relations: Indian Foreign Policy
(Credit: 5)

This course provides an overview of the evolution, principles, and strategic direction of Indian foreign policy from independence to the present. It examines India's relations with key global and regional actors and explores the domestic and international factors that shape its diplomatic stance. By analysing major phases and shifts, students will assess India's transition from a postcolonial nation to an aspiring global power.

After completing this course, the students are expected to

- Understand the different determinants of foreign policy of India.
- Know the core principles of Indian foreign policy.
- Know the relationship of India with major powers as well as neighboring countries.
- Know the role of India with regional organizations.

DS 10
(PLSDSC510T)
Western Political Thought – 1
(Credit: 5)

This course explores foundational political ideas from ancient Greece to early modern Europe, tracing the key concepts of justice, citizenship, sovereignty, and social contracts. Through engagement with thinkers like Plato, Aristotle, Machiavelli, Hobbes, Locke, and Rousseau, students will examine the philosophical roots of modern political systems. The course emphasizes comparative perspectives and relevance to contemporary political debates.

After completing this course, the students are expected to

- Understand philosophical foundation of politics.
- Know the different concept of western political philosophers.
- Differentiate the concept of politics from religion and morality.
- Understand the concept of natural rights, liberty, property, sovereignty etc.

DS 11
(PLSDSC511T)
Indian Political Thought – 1
(Credit: 5)

This course examines key themes in Indian political philosophy through Brahmanic, Shramanic, Islamic, and syncretic traditions. Students will engage with foundational texts to understand the concepts of state, justice, kingship, and moral governance. Emphasis is placed on thinkers such as Kautilya, Ved Vyasa, Manu, and Kabir to explore indigenous political ideas in context.

After completing this course, the students are expected to

- Understand the ancient Indian politics.
- Know the traditions of Brahmanic, Shramanic and Islamic thought in India.
- Know the duties of rulers, societal hierarchy in India.

DS 12
(PLSDSC612T)
Political Sociology
(Credit: 5)

This course explores how society shapes political behaviour, institutions, and power structures. It introduces key concepts such as political culture, socialisation, participation, and communication, with a focus on the Indian context. Students will critically examine themes such as development, stratification, and military intervention to understand the socio-political fabric of the region.
After completing this course, the students are expected to

- Understand the concept of political culture, political socialization, political participation and political communication.
- know the electorate and electoral behavior in Indian context.
- Learn the theories of political development, modernization and social change.
- Able to think critically the role of caste, tribes, class and religion in Indian politics.
- Understand in what conditions military intervenes in politics.

DS 13
(PLSDSC613T)
Gender and Politics
(Credit: 5)

This course critically engages with gender as a political and social construct, examining feminist theories and the shifting paradigms of patriarchy, equality, and identity. Through global and Indian contexts, it explores the intersections of gender, power, development, ecology, and reform. Students will analyse how feminist thought challenges dominant structures and reshapes political discourse.

After completing this course, the students are expected to

- Understand the concept of 'gender' and its various aspects.
- Learn what is 'feminism' and its different theories.
- Know the concept of patriarchal society.
- Know the conditions of women in pre-independent India.
- Learn the various women's movements in post-independent India.
- Explain gender going beyond the 'binary'.

DS 14
(PLSDSC614T)
Western Political Thought – 2
(Credit: 5)

This course introduces students to key political ideologies and thinkers, spanning utilitarianism, liberalism, feminism, socialism, anarchism, and post-Marxist theory. Through critical engagement with primary texts and debates, it explores concepts such as liberty, justice, rights, and the state. Students will gain historical context and analytical tools to assess the relevance of these ideas in modern political discourse.

After completing this course, the students are expected to

- Understand the political philosophy of J. Bentham, J.S.Mill and Hegel.
- Understand the knowledge about feminist thinkers' thoughts on women rights, education and social respect and opposition to patriarchal society.
- Learn about socialism and its various forms, anarchism and debates within communism.

DS 15
(PLSDSC615T)
Indian Political Thought – 2
(Credit: 5)

This course explores themes and debates in modern Indian political thought through writings of reformers, revolutionaries, and philosophers. It examines ideas of justice, nationalism, socialism, gender, caste, and community articulated by thinkers like Rammohun Roy, Pandita Ramabai, Gandhi, Ambedkar, Tagore, and others. Students will engage with diverse visions of political transformation that shaped India's historical and ideological landscape.

After completing this course, the students are expected to

- Understand the political thought of Raja Rammohun Roy, Pandita Ramabai, Gandhi
- Know the concept of caste system, social justice and Gandhi-Ambedkar debate.
- Understand the concept of socialism of Vivekananda and Subhas Chandra Bose.

- Learn Tagore's concept of nationalism and internationalism, Iqbal: Nationalism and Community, Savarkar's Hindutva; Jinnah: Two-Nation Theory, M.N. Roy: Radical Humanism.

DS 16
(PLSDSC716T)
Research Methodology in Social Science
(Credit: 5)

This course equips students with essential tools for conducting systematic political science research. It covers core concepts, research designs, and both quantitative and qualitative approaches. Through engagement with methods of data analysis, proposal writing, and academic referencing, students will gain practical and analytical skills necessary for rigorous inquiry in social science.
After completing this course, the students are expected to

- Understand the meaning of research, its types, purpose of research. And
- Learn the importance of research methodology and different techniques to be used in research.
- Understand to write the research proposal and research reports / Dissertations
- Learn the basic statistics like Mean, Median, Mode for data analysis, referencing formats and bibliography.

DS 17
(PLSDSC717T)
Contemporary Debates in Politics
(Credit: 5)

This course engages students in critical analysis of political ideas, institutions, and global phenomena shaping the 21st century. It explores debates on justice, democracy, and power while addressing globalisation, digital politics, multiculturalism, and environmental ethics. Drawing from diverse theoretical traditions and perspectives, students will develop insights into the complexities of contemporary political discourse.

After completing this course, the students are expected to

- Understand the contemporary major school of thought like Liberalism, Marxism, Communitarianism, Libertarianism, Neo-Marxism, Post-Modernism etc.
- Learn Rawlsian and post-Rawlsian Debate on justice and equality, concept of Global Justice.
- Learn the Foucault's concept of power and critiques of western thought.
- Understand the crisis of representation and populism in democracy.
- Understand the role of sovereignty in the era of globalization and politics of identity.

DS 18
(PLSDSC818T/ PLSRES801T (H .w.R)
International Relations: Global Politics
Credit: 5

This course introduces students to key global transformations and pressing political challenges shaping the post-Cold War world. It explores shifting power dynamics, regional conflicts, globalization, and the evolving role of the Global South. Students will critically examine transnational issues—such as migration, environmental cooperation, terrorism, and nuclear disarmament—to develop a nuanced understanding of international politics in a rapidly changing world.

After completing this course, the students are expected to

- Understand world politics during cold war and post-cold war.
- Learn about international regional organization like European Union and Brexit.

- Understand the role of Global South in world politics.
- Know the West Asian politics.
- Understand the concept of Globalization, Terrorism, and Environmental and Nuclear politics.

DS 19
(PLSDSC819T)
Understanding Governance
(Credit: 5)

This course introduces students to governance theory and practice in contemporary political systems, focusing on democratic accountability, public service delivery, and citizen engagement. It examines governance models—local, digital, and green—through key concepts and Indian case studies. Students will analyze how state, market, and civil society shape effective, inclusive, and sustainable governance.

After completing this course, the students are expected to
- Understand the meaning of Governance, Good Governance and Local Governance.
- Learn Gandhi's idea of Swaraj.
- Know the role of State, Market and Civil Society in India since the 1990s.
- Learn about Lokpal , Lokayukt, Right to Information, Citizens' Charter, E-Governance and Green Governance.

DS 20
(PLSDSC820T)
Human Rights and Politics
(Credit: 5)

The course provides students an overview of Human Rights and international provisions to secure them. It builds conceptual understanding of human rights and enables critical examination of key issues, while introducing institutional frameworks and laws at international and national levels.

After completing this course, the students are expected to
- Understand the meaning of Human Rights, Foundation and Evolution of Human Rights.
- Learn about the different political ideologies of Human Rights like Liberalism, Socialism, and Conservatism.
- Know the various international frameworks of Human Rights like ICCPR and ICESCR (1966); UNHRC and ICJ and ECHR, ACHPR, IACHR.
- Understand the Human Rights in Indian context.

DS 21
(PLSDSC821T)
Environment and Politics
(Credit: 5)

This course aims to introduce students to the Indian perspective of public administration. This will help them develop an understanding of how different administrative institutions in India evolve and function. It has been designed to give the students an idea of different crucial social welfare policies in India.

After completing this course, the students are expected to
- Understand the meaning of Environmentalism and its different waves.
- Learn about the concept of Sustainable Development, Ecological Modernization and Earth Democracy and Green Political Theory.
- Learn about Gandhi and Marx on Environment.
- Understand the Climate Change and Global Warming, Different Actors in Environmental Politics and Environmental Ethics.

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
PLSHSE101M/PLSHSE303M
Democratic Awareness through Legal Literacy
(Credit:3)

Legal literacy is an extremely vital part of a citizen's life. Without such awareness about basic laws and institutions, the ability of citizens to redress violation of their rights is severely compromised. Awareness about the law and legal procedures enable people to plan their behaviour in tune with a complex, diverse and collective setting.

After completing this course, the students are expected to,

- acquire knowledge about the structure, functions and various features of the legal system in India.
- develop skills in legal matters by gaining awareness about various law enforcement institutions and crucial laws that govern their public and personal lives.
- learn basic legal processes like filing a First Information Report (FIR), understand the meaning and process of legal issues like bail, seizure etc and develop a basic knowledge of laws that would enable them to maintain relation with the state from an informed position.
- become empathetic, responsible citizens who will have application skills regarding use of the legal system and relevant laws for redressal of grievances, thereby assisting those in need when required.

SE-2
(PLSHSE202M)
Survey Research in Social Science
(Credit:3)

Political Science is a discipline of praxis. Hence real understanding of concepts and events require field exposure of learners and effective social interaction in real life situations. The aim of the course is to enable the students develop practical application skills of survey research methodology to find answers to political questions.

After completing this course, the students are expected to,

- develop enhanced skill level regarding survey work in social science and realize its importance for impactful research.
- have knowledge about sample survey like how to prepare samples from wider number of cases for survey, apply the relevant sampling technique in sync with the research type etc.
- know the technicalities of conducting interviews, prepare a questionnaire and various ethical dimensions related to it.
- learn data analysis techniques to address the questions raised in research.

Such an interdisciplinary course drawing heavily on Sociology will thus enhance their research skills for a future career in research as well as in organizations like media houses and others which rely on these methods for activities like poll prediction and analysis etc as well as NGOs conducting social surveys etc.

MULTI-DISCIPLINARY COURSE (MDC)

MD
(PLSHMD101M/PLSHMD202M/PLSHMD303M)
GENDER AND POLITICS
(CREDIT:3)

Gender has catapulted to a central position in social science discourses. Attempts are underway to understand and assess issues using the gender lens not just in the academic world but also in daily existence starting from family to wider policy circles. Difference between sex (biological) and gender (social construction) is being highlighted along with questions of stereotypical attributes and roles. The primary aim of this course design is to sensitize students on the idea of gender and related issues. It puts forward key concepts, theoretical positions and varied perspectives as a matter of critical discussion. A multidisciplinary approach has been adopted to viably grasp the cross-cutting subject of gender.

After completing this course, the students are expected to,

- understand and internalize the concept of gender and its reflections in daily life.
- know how different schools have understood patriarchy and feminist questions differently.
- learn the origin, evolution, theoretical foundations and key issues which are at the core of the feminist movement in Anglo-American world.
- know the history of women’s movement in India and critically analyse the present status of women in family and broader socio-political arena.
- learn various issues like development and environment from gender perspective.
- develop analytical abilities to grasp different debates on the issue and form own productive opinions.

Such an inter-disciplinary course in expected to enhance among the students the sense of civic responsibility along with an ethical sense committed towards positive change, equity-based development and just society.

For UG NEP2020 syllabus of **Political Science** in West Bengal State University click link bellow:

1. https://wbsu.ac.in/web/nep-syllabus/
2. https://wbsu.ac.in/web/wp-content/uploads/2025/09/UG-NEP_FULL-SYLLABUS_POLSC_SEM-1-8_19.09.2025_For-Circulation.pdf

Program and Course Learning outcome of Undergraduate course

Department of Statistics

BIDHANNAGAR COLLEGE

SALTLAKE

INTRODUCTION

The B.Sc. Major in Statistics under the NEP 2020 syllabus at West Bengal State University is an innovative and rigorous four-year honours program (with intermediate exit options after 1, 2, or 3 years) that blends theoretical foundations, practical applications, and multidisciplinary exposure in line with NEP's vision. In the first year, students build a strong statistical base through courses in Descriptive Statistics, Probability Theory, practical lab work, introduction to software such as R, and related computer-based exercises. Subsequent semesters expand into Sampling Distributions, Statistical Inference, Design of Experiments, Applied Statistics, and Operations Research, alongside field visits, study tours, workshops, and internally-rounded evaluations. The curriculum emphasizes hands-on learning—students analyze real-world datasets, conduct lab-based experiments, and engage with statistical software programs—supported by small practical batches guided by faculty. In later years, the program integrates interdisciplinary electives (e.g., Statistical Inference, Biostatistics and Financial Statistics), soft skills, and digital literacy components, fostering critical thinking, data-driven decision-making, and ethical research aptitude. Designed to meet NEP 2020's goals of learner-centricity and flexibility, the B.Sc. in Statistics equips graduates with the analytical, computational, and communicative competencies needed for careers in data science, finance, public policy, research, and teaching, as well as pathways to advanced studies in statistics and allied fields.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

PROGRAMME OUTCOMES	
PO1:	Students acquire knowledge about the concepts of Statistics.
PO2:	Undertake hands on lab work activities that help developing in students' practical knowledge and skills on qualitative and quantitative analyses, required for pursuing career in different fields.
PO3:	Recognize and appreciate the importance of the statistical sciences and its application in academic, industrial, economic, medical and social contexts.

PROGRAMME SPECIFIC OUTCOMES	
PSO1:	Demonstrate the ability to use skills in Statistics and its related areas of technology for formulating and tackling Statistical related problems and identifying and applying appropriate principles and methodologies to solve a wide range of problems associated with Statistics.
PSO2:	Acquire (i) a fundamental/systematic or coherent understanding of the academic field of Statistics, its different learning areas and applications in Medical Statistics, Agricultural Statistics, Financial Statistics, Population Statistics, Clinical Trials and Epidemiology, Stochastic Processes, etc. (ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Statistics, including professionals engaged in research and development, teaching, and government/public service; (iii) skills in areas related to one's specialization area within the disciplinary/subject area of Statistics and current and emerging developments in the field of Statistics.
PSO3:	Recognize the importance of statistical modelling simulation and computing, and the role of approximation and mathematical approaches to analyze the real-world problems.
PSO4:	Plan and execute Statistical related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Statistics.
PSO5:	Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Statistics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries; (ii) investigative skills, including skills of independent investigation of Statistics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Statistics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the ability to work both independently and in a group.
PSO6:	Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying, or misrepresenting data or committing plagiarism; (ii) the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.
PSO7:	Integrate concepts from multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Statistics
PSO8:	Develop communicative skill and human values.

PSO – CO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
DS-1	√	√		√	√		√	
DS-2	√	√		√	√		√	
DS-3			√		√		√	
DS-4			√		√		√	
DS-5	√	√			√		√	
DS-6	√	√		√	√		√	
DS-7	√	√		√	√	√	√	
DS-8	√	√		√	√	√	√	
DS-9	√	√	√	√	√	√	√	
DS-10	√	√		√	√	√	√	
DS-11	√	√		√	√	√	√	
DS-12	√	√	√	√	√	√	√	
DS-13	√	√		√	√	√	√	
DS-14	√	√		√	√	√	√	
DS-15	√	√	√	√	√	√	√	
DS-16	√	√	√	√	√	√	√	
DS-17	√	√	√	√	√	√	√	
DS-18	√	√		√	√	√	√	
DS-19	√	√	√	√	√	√	√	
DS-20	√	√	√	√	√	√	√	
DS-21	√	√	√	√	√	√	√	
DS-22	√	√	√	√	√	√	√	
DS-23	√	√	√	√	√	√	√	
DS-24	√	√	√	√	√	√	√	
SE-1			√	√			√	
SEC2			√	√			√	
SE-3							√	
MA-1/MB-1							√	
MA-2/MB-2							√	
MA-3/MB-3							√	
SM-1/SM-2							√	
MD-1/MD-2/MD-3							√	
SE-1	√		√		√	√		
SE-2	√		√		√	√		
SE-3							√	
AE-1								√
AE-2								√
AE-3								√
VA-1								√
VA-2								√

COURSE LEARNING OUTCOME

MAJOR COURSES(DSC – Department Specific Course)

DS-1
STSDSC101T & STSDSC101P
Descriptive Statistics-I and Probability-I

At the end of this course a student should be able to understand

1. Different types of data and the art of data handling.
2. The techniques of summarization and identification of the salient features of the data through graphical displays and other descriptive measures.
3. The salient features of metric data related to a single variable
4. different definitions and meaning of Probability.
5. Know different laws of probability and the theorems connecting them.
6. Be able to apply the laws of probability.
7. Know the notion of conditional probability.

In practical at the end of the course a student should understand

1. Basics of C ++ language
2. Some theoretical as well as practical programming of numerical methods using C++

DS-2
STSDSC201T & STSDSC201P
Descriptive Statistics-II and Probability-II

At the end of the course a student should understand

1. The salient features of metric data related to two variables
2. Association between two variables
3. Association between two attributes
4. Understand what is a random variable and its probability distribution.
5. Understand different aspects of univariate discrete probability distribution.

In practical at the end of the course a student should understand

1. Basic statistical data analysis using Excel
2. Basic statistical data analysis using Minitab
3. Basic statistical data analysis using R

DS-3
STSDSC303T
Mathematical Analysis-I

At the end of the course a student should understand

1. Different properties of real numbers.
2. Different properties of sequence and series.
3. Different tests of convergence.
4. Properties of real valued functions.
5. Different properties of functions on several variables.
6. Different properties of sequence and series of functions.

DS-4
STSDS404T & STSDSC404P
Vector and Matrix Algebra

At the end of the course a student should understand

1. Theory of Equations
2. The fundamental concepts of matrices and determinants
3. Echelon form
4. Linear equations
5. Rank of a Matrix
6. Characteristic roots and vectors
7. Quadratic forms
8. Partitioning of matrices
9. Generalised Inverse

DS-5
STSDS405T & STSDS405P
Sampling Distribution & Statistical Inference I

At the end of the course a student should understand

1. Chi square distribution.
2. t and F distributions and their applications.
3. Order statistics and distribution of sample median and range.
4. Sampling distribution of sample correlation coefficient and regression coefficient
5. Maximum Likelihood Estimation for unknown population parameters, their advantages and disadvantages
6. Desirable properties of point estimators based on which estimators can be compared
   i) Unbiasedness
   ii) Sufficiency
   iii) Efficiency
7. Methods to develop/find best point estimators based on the desirable properties (Using Cramer- Rao inequality, Rao-Blackwell theorem, and Lehmann-Scheffe Theorem).
8. Practical applications of estimation theory pertaining to all discussed methods.

DS-6
STSDS406T & STSDS406P
Probability Theory III

At the end of the course a student should understand

1. Moments & different probability inequalities
2. Generating function
   i)Probability generating function
   ii) moment generating function
   iii) cumulant generating function
   iv) characteristic function
3. Convergence in distribution and probability
4. Continuous univariate probability distributions with their properties.
5. Bivariate probability distributions and their properties

DS-7
STSDS407T & STSDS407P
Survey Sampling

At the end of the course a student should understand

1. Draw random sample from a closed finite homogeneous population.
2. Estimate different population parameters along with their error of estimate
3. Draw sample from a large heterogeneous population and subsequent estimation process based on that sample.
4. Different optimization technique for drawing samples from different segments of a population within a limited resource.
5. Designing complex survey with samples drawn in multiple stages and getting subsequent estimates.

DS-8
STSDSC508T & STSDSC508P
Statistical Inference-II

At the end of the course a student should understand

1. Basics of hypothesis testing
2. Type I and type II error
3. Critical region and p value
4. How to construct different types of optimal statistical tests
5. How to construct confidence intervals
6. How to perform sequential analysis

DS-9
STSDSC509T & STSDSC509P
Linear Models

At the end of the course a student should understand

1. How to build a linear model
2. How to transform regression models into a linear model
3. Theory of Gauss Markov model-Estimation
4. Theory of Gauss Markov model-Hypothesis testing
5. Regression model and its diagnostic checking

DS-10
STSDSC510T
Mathematical Analysis II and Linear Algebra II

At the end of the course a student should understand

1. Eigenvalues, eigenvectors
2. Quadratic form and its different types
3. Riemann and improper integrals
4. Sequence and series of functions
5. Functions of several variables

DS-11

STSDSC511T & STSDSC511P

Statistical Quality Control

At the end of the course a student should understand

1. Definition of quality and different types of control charts
2. Single sampling inspection plans for attributes
3. Double sampling inspection plans for attributes
4. Different types of six sigma training plans

DS-12

STSDSC612T & STSDSC612P

Stochastic Processes and Time Series Analysis

At the end of the course a student should understand

1. Different components of time series data
2. How to estimate trend component
3. How to estimate seasonal component
4. Different types of stochastic processes, in particular, Markov chain
5. Estimation of time series models and forecasting

DS-13

STSDSC613T & STSDSC613P

Large Sample Theory

At the end of the course a student should understand

1. Different types Convergence: convergence in probability, convergence in distribution, convergence in r th mean, almost sure convergence, etc.
2. Delta method and variance stabilizing transformations
3. Derivation and uses of large sample distributions of different statistics
4. Different optimal asymptotic properties.
5. Uses of Pearsonian chi square in different aspects

DS-14

STSDSC614T & STSDSC614P

Demography Theory

At the end of the course a student should understand

1. Different measures of mortality
2. Construction and use of life table
3. Different measures of fertility
4. Population estimation, projection and forecasting

DS-15

STSDSC615T & STSDSC615P

Multivariate Analysis & Nonparametric Inference

At the end of the course a student should understand

1. Introduction to random vector

2. Multinomial and multivariate normal distributions and their different properties
3. Principal component analysis
4. Different nonparametric tests and their uses

DS-16
STSDSC716T & STSDSC716P
Design of Experiments

At the end of the course a student should understand

1. Analysis of variance for one way and two way classified data
2. Analysis of covariance for one way and two way classified data
3. Design of experiments and different types of models
4. Factorial experiments and confounding

DS-17
STSDSC717T & STSDSC717P
Numerical Analysis and Statistical Computing

At the end of the course a student should understand
1. Different types of interpolation
2. Different methods of numerical integration and numerical differentiation
3. Different methods to solve transcendental equations
4. Basic simulation techniques
5. Monte Carlo integration
6. Different resampling techniques
7. Uses of EM algorithm

DS-18
STSDSC818T & STSDSC818P
Economic Statistics and Official Statistics*

At the end of the course a student should understand
1. Different types of index numbers and their constructions
2. How to measure poverty and economic inequality
3. Measures of unemployment and gender inequality
4. Present official statistical system of India

DS-19
STSDSC819T & STSDSC819P
Discrete Data Analysis*

At the end of the course a student should understand
1. Analyses of contingency tables
2. Generalized linear model and its applications
3. Fitting of generalized linear models for binary and count data
4. Different models for contingency tables

DS-20
STSDSC820T & STSDSC820P
Financial Time Series Analysis*

At the end of the course a student should understand

1. Stationary and non-stationary time series data and their fittings
2. Concept of volatility and its modeling and forecasting
3. Concepts of risk, value at risk, etc.
4. Models for value at risk, capital asset pricing model etc.

DS-21
STSDSC821T & STSDSC821P
Introduction to Bayesian Inference*

At the end of the course a student should understand

1. Elements of decision theory and preliminary ideas of decision rule, loss and risk
2. Comparison of two paradigms-frequentist and Baysian
3. Bayesian inference-estimation and testing of hypothesis
4. Application of Bayesian methods: hierarchical and empirical Bayes

DS-22
STSDSC822T & STSDSC822P
Econometrics*

At the end of the course a student should understand

1. Heteroscedasticity in statistical models: its consequences and detection
2. Autocorrelation in statistical models and its correction
3. Presence of multicollinearity in statistical models and its detection through statistical tests
4. Fitting of regression model after making adjustments for heteroscedasticity, autocorrelation and multicollinearity.

DS-23
STSDSC823T & STSDSC823P
Survival Analysis and Clinical Trials*

At the end of the course a student should understand

1. Basics of survival analysis and censoring
2. Estimation of mean survival time and variance of the estimators
3. Testing of hypotheses and model fitting
4. Basics of clinical trials and discussions of different historical clinical trials

DS-24
STSDSC824P
Research Project Dissertation**

At the end of the course a student should understand

1. How to write a dissertation and present a statistical report
2. The need of hands on training to the students to deal with data emanating from some real life situations

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
STSHSE101T & STSHSE101P/STSHSE303T & STSHSE303P
Numerical Computations with C

At the end of the course a student should understand

1. Basics of C ++ language
2. Some theoretical as well as practical programming of numerical methods using C++

SE-2
STSHSE202P
Computation using software

At the end of the course a student should understand

1. Basic statistical data analysis using Excel
2. Basic statistical data analysis using Minitab
3. Basic statistical data analysis using R

MULTIDISCIPLINARY COURSE (MDC)

MD-1
STSHMD101M/ STSHMD201M/ STSHMD301M
Statistics for practitioners

At the end of the course a student should understand

1. The methods of collecting data
2. Compilation of data
3. Summarization of data
4. Use of Statistics in different fields

For UG NEP2020 syllabus of Statistics in West Bengal State University click link bellow:

https://wbsu.ac.in/web/wp-content/uploads/2025/07/WBSU_Statistics_CCF_UG_Syllabus-Final-Newly-Revised.pdf

Program and Course Learning outcome of Undergraduate and Post Graduate course

Department of Zoology

BIDHANNAGAR COLLEGE

SALTLAKE

INTRODUCTION

The B.Sc. Major in Zoology at West Bengal State University, restructured per NEP 2020 guidelines, is a comprehensive four-year honours programme that integrates core disciplines—ranging from non-chordate and chordate taxonomy to physiology, biochemistry, molecular biology, ecology, evolution, developmental biology, biotechnology, histology, entomology, parasitology, microbiology, immunology, ichthyology, and bioinstrumentation—in a rigorous, student-centred, credit-based curriculum.The curriculum emphasizes hands-on training and modern analytical techniques, with laboratory-intensive practicals accompanying every theoretical module to nurture observational precision, experimental design, and data analysis skills. A flexible choice-based system allows selection of electives and minor streams, vocational courses, and interdisciplinary modules—like aquaculture, sericulture, and community service—promoting both academic and vocational competencies. Additional components, such as summer internships, research-methodology trainings, soft-skill enhancement, and multidisciplinary exposure, support NEP's aim to develop holistic, employable graduates equipped for emerging career paths in conservation, public health, biotech, academia, and environmental management. With an emphasis on conceptual clarity, critical thinking, self-directed learning, and research aptitude, this zoology programme fosters a strong foundation in animal science and prepares students for advanced studies or professional roles in modern zoological arenas.

The M.Sc. in Zoology at Bidhannagar College, under the CBCS semester system affiliated with West Bengal State University, is a two-year advanced programme that combines rigorous theoretical coursework with intensive practical and research-based training. Throughout four semesters, students engage deeply with core disciplines such as non-chordate and chordate structure and function, animal physiology, biochemistry, endocrinology, neurobiology, developmental biology, cell and molecular biology, ecology, animal behaviour, insect biology, parasitology, immunology, fish biology, taxonomy, biodiversity, conservation biology, and applied and biotechnological topics.Complementing these theory courses are equally substantial laboratory components—including histology, biochemistry, molecular methods, ecology, entomology, fisheries, immunoparasitology, field training, comprehensive viva, and a dissertation/project in the final semester.The programme fosters analytical thinking, experimental design, and field-based skills through regular seminars, workshops, guest lectures, and group projects, providing a holistic, multidisciplinary learning environment. Access to upgraded laboratories with modern instrumentation—enhanced through UGC and state grants—ensures hands-on training and robust research infrastructure. With small class sizes and strong faculty guidance, students receive personalized mentoring and gain practical exposure. The inclusion of electives and a major research project aims to develop critical inquiry, problem-solving aptitude, and ready students for careers in academia, research, conservation, environmental management, biotech, and related sectors.

Under Graduate Program and Course Learning Outcome

Courses Offered

Semester 1	Semester 2	Semester 3	Semester 4
DS-1, MA-1, MB-1, MD-1, AE-1, SE-1, VA-1	DS-2, MA-2, MB-2, MD-2, AE-2, SE-2, VA-2	DS-3, MA-3, MB-3, MD-3, AE-3, SE-3,	DS-4, DS-5, DS-6, DS-7
Semester 5	**Semester 6**	**Semester 7**	**Semester 8**
DS-8, DS-9, DS-10, DS-11	DS-12, DS-13, DS-14, DS-15	DS-16, DS-17, SM-1, SM-2	DS-18, DS-19, DS-20, DS-21

Programme Outcomes	
PO1	Acquire a comprehensive understanding of Zoology, including organismal diversity, taxonomy, structure and function, cell and molecular biology, genetics, ecology, evolution, and wildlife biology, and relate this knowledge to societal needs, environmental sustainability, and interdisciplinary scientific contexts.
PO2	Develop proficiency in laboratory techniques, fieldwork, and biological data analysis, enabling them to apply scientific methods, biostatistical tools, and critical thinking to investigate, analyse, and solve biological problems ethically and effectively.
PO3	Communicate scientific and interdisciplinary knowledge clearly and effectively through written and oral forms in diverse contexts, demonstrate ethical responsibility and human values in biological research and societal applications, integrate multidisciplinary perspectives including language and literature, and engage in lifelong learning to keep pace with advances in Zoology.

Programme Specific Outcomes	
PSO1	Understand the basic principles of Zoology, including its historical development, its relevance to society, and its relationship with other scientific disciplines.
PSO2	Identify, describe, and classify organisms, including their taxonomy, morphology, functional anatomy, physiology, ecology, and behaviour.
PSO3	Develop a strong foundation in cell and molecular biology, biochemistry, genetics, developmental biology, endocrinology, parasitology, immunology, entomology, histology, histochemistry, toxicology, cancer biology, biostatistics, animal behaviour, evolution, ecology and wildlife biology and application of this knowledge in the shaping of life processes.
PSO4	Create practical skills in laboratory techniques, fieldwork, and data analysis of datasets. Students will be able to apply the scientific methods to investigate and solve biological problems.
PSO5	Communicate scientific information effectively to different audiences.
PSO6	Demonstrate an understanding of the ethical and societal implications of biological research.
PSO7	Develop a dedication to stay up-to-date with the latest advances in Zoology.
PSO8	Integrate concepts from Multidisciplinary subjects to enhance their understanding of their principles and effectively apply them in various areas of Bengali Language and Literature.
PSO9	Written and oral communication skills of the students will be enhanced enabling them to express ideas clearly and effectively in various contexts along with the skills in developing human values

PO-CO Mapping

Courses	PROGRAM SPECIFIC OUTCOME								
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
DS-1	✓	✓		✓	✓	✓	✓		
DS-2	✓	✓		✓	✓	✓	✓		
DS-3	✓	✓		✓	✓	✓	✓		
DS-4	✓	✓		✓	✓	✓	✓		
DS-5	✓	✓	✓	✓	✓	✓	✓		
DS-6	✓		✓	✓	✓	✓	✓		
DS-7	✓		✓	✓	✓	✓	✓		
DS-8	✓		✓	✓	✓	✓	✓		
DS-9	✓		✓	✓	✓	✓	✓		
DS-10	✓		✓	✓	✓	✓	✓		
DS-11	✓		✓	✓	✓	✓	✓		
DS-12	✓	✓	✓	✓	✓	✓	✓		
DS-13	✓		✓	✓	✓	✓	✓		
DS-14	✓		✓	✓	✓	✓	✓		
DS-15	✓		✓	✓	✓	✓	✓		
DS-16	✓		✓	✓	✓	✓	✓		
DS-17	✓		✓	✓	✓	✓	✓		
DS-18			-	✓	✓	✓	✓		
DS-19	✓		✓	✓	✓	✓	✓		
DS-20	✓	✓	✓	✓	✓	✓	✓		
DS-21	✓		✓	✓	✓	✓	✓		
SE-1	✓	✓			✓	✓	✓		
SE-2	✓	✓			✓	✓	✓		
SE-3								✓	
MA-1/ MB-1								✓	
MA-2/ MB-2								✓	
MA-3/ MB-3								✓	
SM-1/ SM2								✓	
MD-1/MD-2/ MD-3								✓	
AE-1									✓
AE-2									✓
AE-3									✓
VA-1									✓
VA-2									✓

COURSE LEARNING OUTCOME

DEPARTMENT SPECIFIC COURSE (DSC)

DS-1
ZOODSC 101T & ZOODSC 101P
Non-Chordates I Theory & Lab

1. Students who have a concrete understanding of the anatomy and functions of invertebrate animals throughout evolution will be able to appreciate the diversity of lower and higher invertebrates, such as mollusks, echinoderms, and arthropods.
2. The role of various invertebrate creatures in agriculture and human health, as well as diseases caused by invertebrates and how they are spread by invertebrate animals, will be understood by the students.
3. Hands-on training will raise knowledge of the value and economic importance of invertebrates.

DS-2
ZOODSC 202T& ZOODSC 202P
Non-Chordates II Theory & Lab

1. Students who have a solid understanding of the anatomy and functions of invertebrate animals throughout evolution will be able to appreciate the diversity of lower and higher invertebrates, such as mollusks, echinoderms, and arthropods.
2. The role of various invertebrate creatures in agriculture and human health, as well as diseases caused by invertebrates and how they are spread by invertebrate animals, will be understood by the students.
3. Hands-on training will raise knowledge of the value and economic importance of invertebrates.

DS-3
ZOODSC 303T& ZOODSC 303P
Chordates Theory & Lab

1. Students who have a solid grasp of the architecture and functions of chordate animals throughout evolution will be able to comprehend the diversity of lower and higher vertebrates, including the different specialties and diversities found in Agnatha, Pisces, Amphibia, Reptilia, Aves, and Mammals.
2. The main goal of the course would be to raise awareness of chordates' economic significance and importance.
3. In order to aid in their research, students will understand the role of many chordate traits, including migration in birds, regeneration, parental care, snake poisoning and biting mechanisms, metamorphosis, and others.
4. The information and hands-on experience gained from this course will be beneficial to a student pursuing a career in zoological gardens, experimental biology, or wild life research.

DS-4
ZOODSC 404T & ZOODSC 404P
Comparative Anatomy and Physiology Theory & Lab

1. The course will give students a more sophisticated understanding of the fundamental structural similarities, differences, and uniqueness in a few families of vertebrates.
2. The structure-function link in terms of the mammalian system will be introduced to physiology students, helping them to comprehend and evaluate both evolutionary and medical facts.
3. In addition to helping students in the domains of drug design, toxicology, pharmaceutical science, and clinical experiments, comparative anatomy and physiology will allow them to examine experimental results in comparable models.

DS-5
ZOODSC 405T & ZOODSC 405P
Ecology Theory & Lab

1. The relationships between the distribution and abundance of creatures in nature would be recognizable to the students.
2. Students who take the course will learn about the various ways that organisms interact with their biological and physical surroundings.
3. In the context of ecosystems, they might examine interactions and assess how the habitat influences species abundance and distribution.
4. Students would graduate from the course with the ability to assess the connections between habitat context and ecological interactions.
5. Finally, the thorough research would undoubtedly assist the students in identifying the ways in which ecological interactions and habitat tolerance are influenced by the evolution of organism form and function, as well as how ecological processes influence these changes.

DS-6
ZOODSC 406T & ZOODSC 406P
Cell Biology Theory & Lab

1. The student's understanding of the function of life will be aided by their knowledge of cell biology.
2. Along with addressing issues of cellular illnesses and their related health implications in human society, it will also set the groundwork for comprehending the significance of cell biology in our daily lives.
3. Research on cell biology is crucial, because it has connections to pathology, basic science, the pharmaceutical business, and other relevant topics.

DS-7
ZOODSC 407T & ZOODSC 407P
Biochemistry Theory & Lab

1. Students can comprehend and analyze the main idea of life and the mechanisms that underlie it.
2. To develop a cohesive grasp of any biological topic, students can interact with the various scientific disciplines.
3. Understanding this course will aid a student in comprehending how biological principles are interpreted chemically.
4. Research in both basic and clinical settings uses this area of interdisciplinary science. It broadens our knowledge of biological investigations, particularly molecular decoding of biological issues.
5. Among other things, this course helps students grasp the fundamentals of science, the environment, ecology, physiology, drug action and discovery, agricultural science, pharmaceutical science, medical science, and evolutionary science.

DS-8
ZOODSC 508T & ZOODSC 508P
Molecular Biology Theory & Lab

1. In addition to knowledge, the student will comprehend and evaluate the molecular processes that take place within living things (cellular).
2. Designing experiments to decipher, modify, and innovate molecular puzzles will be made easier with this understanding.
3. In many basic and clinical science domains, molecular biology currently focuses on increasingly significant gene manipulation. It finds extensive use in biotech firms, crop science, medical therapies, diagnosis, and research in general.

DS-9
ZOODSC 509T & ZOODSC 509P
Genetics Theory & Lab

1. A student who completes this course should be well-versed in both the classical and molecular approaches to understanding genes, as well as a variety of other elements of genetics.
2. They will be able to comprehend biology holistically as a result. They will learn about the several methods used to investigate genetics and develop the ability to analyze, compare, and explain the outcomes of genetics investigations. This will support their future genetics research projects and further studies, as well as their competitive exams for further education.

DS-10
ZOODSC 510T & ZOODSC 510P
Animal Behavior & Chronobiology Theory & Lab

1. The theoretical and experimental protocols of both sciences are covered in this course. This course's scope is extremely important and demanded in scientific/pharmaceutical labs as well as industry (animal breeding and rearing).
2. The knowledge and hands-on experience gained from this course will be beneficial to a student pursuing a career in zoological gardens, experimental biology, or wild life research.

DS-11
ZOODSC 511T & ZOODSC 511P
Endocrinology, Histology & Histochemistry Theory & Lab

1. The endocrine system gives an overview of maturation, reproduction, homeostasis, maintenance, and an understanding of how physiology functions. In contrast, histology is one of the most effective tools for comprehending both diagnostic and experimental physiology.
2. If used properly, the tool will allow students to assist in laboratory testing, toxicology, pharmaceutical science, medical diagnostic centers, and medication discovery.

DS-12
ZOODSC 612T & ZOODSC 612P
Biostatistics & Taxonomy Theory & Lab

1. Students who successfully complete this course will have a basic understanding of how to express and analyze quantitative data in zoology.
2. They will acquire practical skills in data display, analysis, and interpretation in addition to understanding the necessity and goal of statistical data analysis.
3. They will be able to do data analysis and develop the analytical skills necessary for research as a result.
4. Through acquiring a solid understanding of taxonomy, students will be better equipped to recognize and categorize creatures.
5. Additionally, they will have practical experience building phylogenies, which will contribute to their deeper comprehension of evolutionary biology. In the future, it will allow students to pursue taxonomy-related research or advanced education and offer them the chance to work as taxonomists.

DS-13
ZOODSC 613T & ZOODSC 613P
Developmental Biology Theory & Lab

1. The ability to comprehend, evaluate, access, and contrast different physical, chemical, and climatic influences on animal development and homeostasis will be learnt by the students. The information will assist the learner in making scientific interpretations of experimental findings

and conclusions (in the discipline).

2. The information also aids in understanding other illnesses, like as cancer and birth defects/abnormalities, where such development is not present.
3. Biotech firms, toxicological investigations, medicinal therapies, diagnosis, and research in general all make extensive use of this science.

DS-14
ZOODSC 614T & ZOODSC 614P
Evolutionary Biology Theory & Lab

1. By the completion of this course, students will have a general understanding of evolution and be familiar with the molecular, population genetic, and morphological methods to understanding evolution.
2. In addition to being able to analyze, compare, and explain evolutionary trends, students will gain abilities in developing evolutionary thinking.
3. They will gain understanding of the many methods used to research evolution and learn how to use intelligence to comprehend evolutionary changes in a population genetic framework.

DS-15
ZOODSC 615T & ZOODSC 615P
Immunology Theory & Lab

1. The student will acquire the ability to comprehend, evaluate, access, and contrast different facets of immune response to infection, immune function/dysfunction, and general molecular understanding of immune function.
2. Additionally, the course will teach the student how to use the immune system in contemporary analysis and treatment.
3. Students who wish to do research on the fundamental and clinical facets of the immune system may find this course beneficial. This science is widely used in pharmaceutical research, medical therapies, biotech firms, diagnosis, and general research.

DS-16
ZOODSC 716T & ZOODSC 716P
Entomology and Vector Biology Theory & Lab

1. Our nation is very interested in and concerned with insect biology. In rural areas, entomologists are being sought to carry out surveys and raise awareness of vector-borne illness management initiatives.
2. In West Bengal, sericulture is also a source of income. Vector biology and human-insect interaction have become increasingly important in defense wing, agriculture, ZSI, forensic labs, etc. In both the fundamental and applied domains, this course is important.

DS-17
ZOODSC 717T & ZOODSC 717P
Biodiversity and Wildlife Conservation Theory & Lab

1. Students who successfully complete the course will be able to explain why society works to preserve biodiversity. They will be capable of recognizing the main risks to biodiversity.
2. They will be able to assess which management choices are most likely to be successful in preserving biodiversity in various contexts with the aid of the course.
3. Students will investigate methods for biodiversity conservation in this course.
4. Students would be better prepared for future work in this sector if they learned the tools and strategies related to biological diversity monitoring. The training would improve the student's capacity to create a field-based project using a logical approach.

DS-18
ZOODSC 818T & ZOODSC 818P
Research Methodology and Scientific Writing Theory & Lab

1. Students who successfully complete this course will understand the procedures involved in doing research.
2. In addition to having a theoretical grasp of the fundamental abilities required for research, they should be able to plan experiments and interpret and explain their findings.
3. In addition to having practical experience with study design, literature evaluation, reference management, plagiarism detection, scientific writing, language editing, and oral presentation, students will be able to effectively convey research findings.
4. For students who plan to conduct research in the upcoming semester or for future higher education, this course will lay the groundwork.

DS-19
ZOODSC819T & ZOODSC819P
Toxicology and Cancer Biology Theory & Lab

1. The epidemiology, clinical diagnosis, treatment, and prevention of human cancers are learnt by the students.
2. Doctorate holders in cancer biology have a very big and expanding job market because of this massive expenditure in cancer research.
3. Students who take this course will have an advantage if they want to work in the field of cancer biology. Since it will aid students in learning about cancer prevention techniques, lifestyle factors that impact cancer incidence are also being addressed.
4. The course will give students hands-on experience with toxicological techniques, expose them to the study of cytotoxicity, genotoxicity, and oxidative stress markers in a variety of experimental setups, and familiarize them with the fundamental distinctions between cancerous and healthy cells.

DS-20
ZOODSC 820T & ZOODSC 820P
Fish and Fishery Theory & Lab

1. This course will assist the student in understanding and establishing fish and fisheries as a scientific and commercial discipline.
2. In both business and research labs, the extent of fisheries is crucial and highly demanded. With this information, students can find work or support themselves through self-employment. Applications for aquaculture and zebrafish can be found in both commercial and experimental settings.

DS-21
ZOODSC 821T & ZOODSC 821P
Parasitology Theory & Lab

1. Research in zoology, biomedical sciences, and public awareness all heavily rely on parasitology. The connection between these species and humans and their livestock is what gives them significance. Basic and clinical research are two areas in which this area of interdisciplinary science is used.
2. It broadens the knowledge of biological investigations, particularly the molecular interpretation of diseases that result from such associations. Basic science, health physiology, drug action/discovery, pharmaceutical science, medical science, evolutionary science, diagnosis, and biotech corporations are just a few of the areas in which this course finds use.

SKILL ENHANCEMENT COURSE (SEC)

SE-1/SE-3
ZOOHSE 101M/ ZOOHSE 301M
Poultry Farming Theory

Course outcome:

- Students have the option to work for themselves as entrepreneurs. Government programs for the industries are also covered in the course.
- The different breeds, varieties, and other topics covered in the course will allow the learner to access real-life situations.

SE-2
ZOOHSE 202M
Vermicompost Production

Course outcome:

- The student understands the importance of vermicompost both as industry as well as a health and environmental prospect.
- The student learns its application to the soil along it its scope and opportunities in organic farming.
- The course bring to light to the student of how this earthworm utilizing technology produces a peat like cast with high water retention capacity coupled with nutrient rich substrates.
- This technology has economic and environmental aspects as it produces sellable soil produced from sewage and waste.

MULTIDISCIPLINARY COURSE (MDC)

MD-1/MD-2/MD-3

LIFHMD101T/LIFHMD201T/LIFHMD301T

Course outcome:

- Understand the causes, transmission, and control of major vector-borne infectious diseases and their public health significance.
- Explain the mechanisms of climate change and assess its impacts on biodiversity and ecosystem stability.
- Analyse the causes and consequences of wetland ecosystem degradation and its effects on biodiversity conservation.
- Identify and describe the structure, functions, and significance of major Indian ecosystems.
- Evaluate the role, achievements, and challenges of environmental movements in India in promoting environmental protection and sustainability.

Post Graduate Program and Course Learning outcome

Courses offered

Semester 1	Semester 2	Semester 3	Semester 4
COR01, COR02, COR03, AEC01	COR04, COR05, COR06, SEC01	COR07, COR08, COR09 GEC01	COR10, COR11, COR12, COR13, COR14

PROGRAMME OUTCOMES	
PO1	Demonstrate comprehensive knowledge of Zoology, including organismal diversity, taxonomy, structure and function, cell and molecular biology, genetics, ecology, evolution, applied and industrial biology, and their historical, societal, and interdisciplinary significance in understanding life processes.
PO2	Develop strong practical competencies in laboratory techniques, fieldwork, instrumentation, diagnostic methods, bioinformatics, and quantitative data analysis, enabling them to apply scientific methodologies to investigate, analyze, and solve biological and environmental problems effectively and ethically.
PO3	Communicate scientific knowledge clearly and effectively to diverse audiences, demonstrate ethical responsibility and awareness of the societal implications of biological research, and engage in lifelong learning to remain updated with emerging advances and technologies in Zoology.

PROGRAM SPECIFIC OUTCOMES	
PSO1	To comprehend the fundamentals of zoology, including its social significance, historical evolution, and interactions with other scientific fields.
PSO2	To recognize, characterize, and group living things according to their taxonomy, morphology, physiology, ecology, behaviour, and functional anatomy.
PSO3	To gain a solid understanding of genetics, microbiology, parasitology, immunology, developmental biology, evolution, animal behaviour, ecology, ecotoxicology, environment management, quantitative biology, cell and molecular biology, physiology, biochemistry, endocrinology, biophysics, histopathology, instrumentation, diagnostic techniques, bioinformatics, industrial and applied biology and wildlife biology, and to apply this understanding to the development of life processes.
PSO4	To develop hands-on abilities in fieldwork, laboratory procedures, and dataset analysis. Students will be able to study and resolve biological issues by using scientific approaches.
PSO5	To successfully convey scientific knowledge to various audiences.
PSO6	To exhibit knowledge of the societal and ethical ramifications of biological research.
PSO7	To cultivate a commitment to remain current with the most recent developments in zoology.

PO-CO Mapping of Post Graduate Course

Course	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
COR01(ZT101 & ZP104)	✓	✓	-	✓	✓	✓	✓
COR02(ZT102 & ZP105)	✓	-	✓	✓	✓	✓	✓
COR03(ZT103)	✓	-	✓	-	✓	✓	✓
AEC01	✓	-	✓	-	✓	✓	✓
COR04(ZT201 & ZP204)	✓	-	✓	✓	✓	✓	✓
COR05(ZT202 & ZP205)	✓	-	✓	✓	✓	✓	✓
COR06(ZT203)	✓	-	✓	-	✓	✓	✓
SEC01	✓	-	✓	-	✓	✓	✓
COR07(ZT301 & ZP304)	✓	-	✓	✓	✓	✓	✓
COR08(ZT302 & ZP305)	✓	-	✓	✓	✓	✓	✓
COR09(ZT303A, ZT303B, & ZT303C)	✓	-	✓	-	✓	✓	✓
GEC01	✓	-	✓	-	✓	✓	✓
COR10(ZT401 & ZPE403A)	✓	-	✓	✓	✓	✓	✓
COR11(ZT402A & ZPE403B)	✓	-	✓	✓	✓	✓	✓
COR12(ZT402B & ZPE403C)	✓	-	✓	✓	✓	✓	✓
COR13(ZT402C & ZPE404A)	✓	-	✓	✓	✓	✓	✓
COR14(ZPE 404B & ZPE 404C)	-	-	-	✓	✓	✓	✓

COURSE LEARNING OUTCOME

CORE COURSES

Core-1
ZT101 & ZP104
Life forms, Evolution & Taxonomy Theory & Lab Course I

1. Every biology student needs to learn the theory of evolution since it is the scientific paradigm for the field. The course's Evolution and Genetics section has been revamped and is specifically designed to equip a postgraduate student with a solid understanding of the most basic biological sciences.
2. After completion of this course, students will gain taxonomy related knowledge and abilities they need to investigate and evaluate ecosystem health and biodiversity. In India and abroad, there are growing opportunities for ecologists with strong taxonomic expertise.
3. Students will gain quantitative skills and a methodological grounding in morphological and molecular taxonomy and systematics procedures. Hands-on training in immunology for better understanding and doing future research in this field will be provided.

Core-2
ZT102 & ZP 105
Genetics, Molecular Biology & Immunology Theory & Lab Course II

1. The goal of the course is to give students a fundamental understanding of the structural and functional characteristics of biological macromolecules, such as proteins, RNA, and DNA. Students can use this knowledge in their research and higher education domains after completing the course.
2. Both general information (useful for daily life) and more in-depth understanding of the subject require an understanding of the fundamentals of microbiology and antibiotics.
3. After completion of the lab course, the students will be well acquainted with common biochemical procedures used in molecular biology labs, like DNA isolation. Additionally, the course will give students a practical grasp of how cellular function can be discovered and understood using contemporary cell and molecular biology tools.

Core-3
ZT 103
Cell Biology & Developmental Biology Theory

1. A useful case study for examining the functional logic of living systems is the cell. Every living thing is composed of cells. The purpose of this course is to examine the foundations of cell biology. We anticipate that students will gain a profound sensibility for comprehending a cell's functioning logic.
2. The course will enable the students to understand the cellular abnormalities and the related health consequences in human society and to highlight the significance of cell biology in our daily lives. The mechanisms underlying the growth and development of complex creatures are studied by developmental biology.
3. Since many health problems may be traced back to early developmental disorders during embryogenesis, the fundamental knowledge of developmental biology serves as a useful basis for other areas of biology and medicine. With a focus on both traditional experiments and contemporary molecular and genetic methods, this course will aid the students in thorough understanding of embryology with a particular emphasis on vertebrate models.

Core-4
ZT 201& ZP 204
Biochemistry & Biophysics Theory & Lab Course III

1. After completing this course, the students will be able to describe the main organization of prokaryotic and eukaryotic cells, identify various groups of biomolecules and their structures, and explain the basic connections between their structure and function.
2. The students can comprehend the main idea of life and the procedures that go along with it. The physical sciences and their use in biological processes are connected by this stream.
3. Students can interact with scientists from many fields to develop a shared understanding of any biological topic.
4. The goal of lab course is to acquaint students with fundamental biochemical methods for designing and conducting experiments. Students will also gain knowledge of histochemical procedures from the course.

Core-5
ZT202 & ZP 205
Parasitology and Microbiology Theory & Lab Course IV

1. The general biology, life cycles, routes of transmission, and pathology of the major parasites that affect human health worldwide are all covered in the course. Students will be able to investigate several significant illnesses and the various protozoans, worms, and arthropods that cause them.
2. Students will have the opportunity to investigate several significant illnesses and the various protozoans, worms, and arthropods that cause them.
3. Students will understand the ability of our immune system to rationally defend against invasive infections or parasites.
4. The goal of the lab course is to provide the students hands-on training on the basics of tropical ecology, such as important habitat characteristics, biodiversity, ecological processes, and biotic interactions.
5. Through group projects and field trips, the course will provide students a firsthand look at ecological study in the tropics.

Core-6
ZT 203
Ecology& Quantitative Biology

1. Understanding the ecological dynamics in threatened habitats is the goal of the ecology component of the course. Their knowledge of conservation biology would enable them to work as professionals or volunteers in conservation. The goal of this course is to get students ready for these kinds of careers.
2. The quantitative biology component of the course was created to allay biology students' purportedly long-standing anxieties about scientific numerical approaches. The subjects covered should aid students in creating surveys or experiments, gathering, and managing scientific data, and, lastly, interpreting the data statistically—skills required in a wide range of occupations, including research.

Core-7
ZT 301 & ZP 304
Physiology & Endocrinology Theory & Lab Course V

1. Students will be able to investigate the functional logic of living systems with the aid of this course.
2. Cells and systems make up every living thing. The purpose of this course is to examine the foundations of body structure and function. To comprehend the functional logic of basic anatomy and physiology, the students will cultivate a strong sense of intuition. The students will

also gain an understanding of the body part anatomy, physiological function, and endocrinological system diseases that have an impact on human society's health in order to highlight the significance of physiology in our daily lives.
3. By examining important physiological factors, the lab course will give students a comprehensive understanding of the idea of homeostasis in humans.

Core-8
ZT 302 & ZP 305
Animal Behaviour& Conservation Biology Theory & Lab Course VI

1. One of the two Nobles for Zoology to date was awarded for research on animal behavior. Since emerging quickly from its psychological confinement, one of the most appealing areas of biology is the study of animal behaviors using an evolutionary method. Students can thrive in research careers in this low-cost, demanding profession far more easily than in any high-cost, equipment-dependent discipline of biology in a country with as much biodiversity as India.
2. The practical course on animal behavior will give students useful skills to prepare them for employment in a variety of animal behavior-related sectors, which is essential for managing zoo animals and broader habitat protection.

Core-9
ZT 303A, ZT 303B & ZT 303C
Genome structure & Genomics, Parasitology &
Immunobiology & Environmental Biology & Ecotoxicology

1. After completing this course, the students will have a fundamental understanding of the structural and functional characteristics of biological macromolecules, such as proteins, RNA, and DNA. Students can use this knowledge in their research and higher education domains after completing the course.
2. The general biology, life cycles, routes of transmission, and pathology of the major parasites that affect human health worldwide are all covered in the course. Students will be able to investigate several significant illnesses and the various protozoans, worms, and arthropods that cause them. Students will have the opportunity to investigate several significant illnesses and the various protozoans, worms, and arthropods that cause them.
3. The course will enable the students to comprehend the ecology and how xenobiotics affect the environment.

Core-10
ZT 401 & ZPE 403A
Modern Techniques & Bioinformatics Theory & Lab Course VII

1. After completing the course, the students will be able to build a bridge between physical science and its application in biological processes. Students can interact with scientists from many fields to develop a shared understanding of any biological topic.
2. The lab course will equip students with the knowledge and skills they need to comprehend the fundamentals of genetic research and apply those ideas to sound research practices.

Core-11
ZT 402A & ZPE 403B
Advanced Genetic Analysis & Human Genetics & Lab Course VII

1. Students can use the knowledge they gain from the advanced genetic analysis course in their research and further education endeavors.
2. The lab course will give students the knowledge and skills they need to identify and locate

parasites as well as comprehend the staining process.

Core-12
ZT 402B & ZPE 403C
Immunoparasitology Theory & Lab Course VII

1. The course will give students a fundamental understanding of the structural and functional characteristics of biological macromolecules, such as proteins, RNA, and DNA. Students can use this knowledge in their research and higher education domains after completing the course.
2. Fundamental ideas about microbiology and antibiotics for both general knowledge (useful in daily life) and more in-depth understanding of the subject will be the take away from this course. The lab course will give students the skills they need to analyze the characteristics of soil and water quality.

Core-13
ZT 402C & ZPE 404A
Environment Management, Tools & Techniques Theory & Lab Course VIII

1. The Environment Management elective will lay the foundation for postgraduate students who want to work as managers or environment analysts in the rapidly developing field of environment management.
2. Students who complete the course will have the skills and information necessary to approach and create scientific issues related to advanced genetic research. The course is to familiarize students with the applied modern methodologies and technologies while also surveying the boundaries of genetic research.

Core-14
ZPE 404B & ZPE 404C
Lab Course VIII

1. Students will gain knowledge and training in immunobiological techniques from the course. Students will gain information and training on parameters pertaining to xenobiotic-induced stress in animal models through this course.

SKILL ENHANCEMENT COURSE
SEC01
Histopathological & Diagnostic Techniques Theory

1. Students will learn about the microscopic characteristics of tissues and organs through this histopathology course, which will enable them to compare the normal with the abnormal in different disease stages.
2. Clinical diagnosis is greatly aided by laboratory testing, and the outcomes frequently guide patient care. To improve the differential diagnosis, tests should be ordered appropriately. It is also critical to comprehend the theoretical underpinnings of these tests and be able to evaluate the results. Students will address difficulties using this diagnostic technique and procedure by applying logical and systematic thinking.
3. Students who complete this course will have an advantage when applying for jobs in diagnostic centers, paramedical facilities, and various histopathology labs.

ABILITY ENHANCEMENT COURSE
AEC01
Industrial & Applied Biology Theory

After completing this course, students can conduct autonomous study and investigation to address real-world issues related to society and industrial applications by integrating scientific and technological knowledge about the utilization of biological processes for industrial goods at the cell and process level.

GENERAL ELECTIVE COURSE
GEC01
Ecosystem & Environmental Hazards Theory

1. Given the enormous decline in biodiversity and the deterioration of natural ecosystems, it is difficult to refute the assertion that all life on Earth is currently in grave danger. Therefore, regardless of their academic specialty, this course is designed to raise awareness and awareness of this survival concern among all students.
2. The course will give students a fundamental understanding of how ecosystem services and biodiversity support human life and other life on Earth, as well as how reckless human activity threatens both.
3. Students who successfully complete this course will be able to describe, monitor, and comprehend environmental systems using the scientific method and quantitative techniques. They will also be able to identify how toxic chemicals used for various purposes are affecting ecosystems and human health.

MINOR COURSE COUTCOMES

BIDHANNAGAR COLLEGE
SALT LAKE

THE FOLLOWING MINOR COURSES ARE OFFERED BY DIFFERENT DEPARTMENTS AS PART OF THE UG UNDERGRADUATE PROGRAM WITH THEIR DIPARTMENT SPECIFIC MAJOR COURSES

Major Subject	Minor Subject 1	Minor Subject 2
BENGALI	History	Political Science
EDUCATION	History / Geography	Political Science
ENGLISH	History	Philosophy / Political
HISTORY	Bengali / English	Political Science
PHILOSOPHY	History / Bengali / English	Education / Political Science
POLITICAL SCIENCE	History / Bengali / English	Philosophy / Education
ANTHROPOLOGY	Geography	Zoology / Botany
BOTANY	Chemistry / Microbiology / Anthropology	Zoology
CHEMISTRY	Physics / Microbiology	Mathematics
ECONOMICS	Statistics	Mathematics
GEOGRAPHY	Economics / Statistics / History / Bengali	Political Science
MATHEMATICS	Statistics / Chemistry	Physics
MICROBIOLOGY	Chemistry	Zoology / Botany
PHYSICS	Chemistry / Statistics	Mathematics
STATISTICS	Economics / Physics	Mathematics
ZOOLOGY	Chemistry / Microbiology / Anthropology	Botany

COURSE OUTCOME OF THE MINOR AND SPACIAL MINOR COUSES OFFERED BY DIFFERENT DEPARTMENTS

DEPARTMENT OF BENGALI

MA-1/MB-1
BNGMIN101T
Study of the History of Bengali Literature and Culture
বাংলা সাহিত্য ও বাঙালির সংস্কৃতি চর্চার ইতিহাস পাঠ

CO1: **Demonstrate an understanding of the historical development of Bengali literature** from its early beginnings to the modern era, including key periods, movements, and authors.
CO2: **Analyze the interrelation between Bengali literature and socio-cultural changes** in Bengal across different historical periods, with a focus on language, identity, and cultural heritage.
CO3: **Critically evaluate representative literary texts and cultural artifacts** in their historical context, fostering appreciation for Bengali literary traditions and their role in shaping regional and national consciousness.

MA-2/MB-2

BNGMIN202T
Study of History of Bengali Language and Linguistics
বাংলা ভাষার ইতিহাস ও ভাষাতত্ত্ব পাঠ

CO1 – Historical Development of Bengali - Understand the origin and evolution of the Bengali language from Old Indo-Aryan to its modern form, identifying major linguistic changes and influences.

CO2 – Linguistic Structure and Analysis - Analyze the phonological, morphological, syntactic, and semantic features of Bengali, with reference to historical linguistics and language change.
CO3 – Language and Society - Evaluate the relationship between Bengali language and society, including dialectal diversity, language policy, and the impact of sociopolitical movements on language use.

MA-3/MB-3

BNGMIN303T
Bengali Children Literature
বাংলা শিশু ও কিশোর পাঠ্য সাহিত্য

CO1 – Foundations of Bengali Children's Literature - Understand the historical development and cultural significance of Bengali children's literature, focusing on its emergence during the Bengal Renaissance.
CO2 – Study of Pioneering Authors - Critically analyze the contributions of Upendrakishore Roy Choudhury, Abanindranath Thakur, and Leela Majumdar, highlighting their themes, narrative styles, and impact on young readers.
CO3 – Literary Appreciation and Societal Values - Evaluate how Bengali children's literature conveys moral, imaginative, and educational values, shaping childhood experiences and reflecting changing social contexts.

SM-1

BNGSMC701T
Study on Thoughts about Poetry and Drama
কাব্যভাবনা ও নাট্যভাবনা পাঠ

CO1: Poetic Modernism in Bengal - Critically analyze the poetic innovations and thematic concerns in Jibanananda Das's writings, situating him within the broader context of modernist Bengali literature.

CO2: Aesthetics and Criticism - Evaluate Abu Sayed Ayub's philosophical and critical reflections on poetry and drama, understanding his role in shaping intellectual discourse in Bengal.

CO3: Revolutionary Theatre Practice - Assess the contributions of Shambhu Mitra and Utpal Dutta to Bengali theatre, with emphasis on performance, political engagement, and dramatic theory.

SM-2
BNGSMC702T
Bengali Science Fiction and Detective Novels
বাংলা কল্পবিজ্ঞান ও গোয়েন্দা কাহিনি

CO1: Bengali Sci-Fi Imagination - Interpret the evolution of Bengali science fiction through the works of Premendra Mitra and Satyajit Ray, focusing on scientific imagination, narrative technique, and socio-cultural context.

CO2: Logic and Legacy in Detection - Analyze the narrative structure, character development, and cultural resonance in detective fiction by Saradindu Bandopadhyay (Byomkesh Bakshi) and Adrish Bardhan.

CO3: Genre and Identity - Compare the distinctive features of Bengali science fiction and detective genres, identifying how they reflect contemporary anxieties, intellectual trends, and indigenous storytelling traditions.

DEPARTMENT OF EDUCATION

MA-1/MB-1
EDUMIN101T
PHILOSOPHICAL FOUNDATION OF EDUCATION
(Credit: 5)

- Demonstrate a clear understanding of the meaning, nature, and scope of education.
- Evaluate the functions and factors that shape the field of education.
- Critically analyze the aims of education from both individualistic and socialistic perspectives.
- Apply the concept of curriculum to design effective educational programs.
- Justify appropriate nature of curriculum for specific educational contexts.
- Develop concept of curriculum & its principles of construction skills.
- Recognize the value and integration of co-curricular activities in educational institution
- Implement child-centric education principles to promote holistic development.
- Apply play and play-way methods in educational setup.
- Promote a balanced approach towards the contribution of the Great educators.

MA-2/MB-2
EDUMIN202T
PSYCHOLOGICAL FOUNDATION OF EDUCATION
(Credit: 5)

- The students were able to know the relationship between Psychology & Education.
- The students were able to know the nature, concept & significance of Educational Psychology.
- The students were able to know the concept, principles, types & stages of human development.
- Familiarize the students with the concept of Physical, Motor, Cognitive, Moral development & their significance in Education.
- The students were able know the concept, nature & determinants of Attention.
- Identify the concept & process of memorization.
- Examine the causes of forgetting.
- Understand the concept, characteristics & types of personality.
- The students will be able to explore the Freudian theory of personality.

MA-3/MB-3
EDUMIN303T
SOCIOLOGICAL FOUNDATION OF EDUCATION
(Credit: 5)

After completion of the course the students will be able to understand –

- The relationship between Sociology & Education.
- The nature, concept & significance of Educational Sociology.
- The concept, nature, types of social group & its significance in Education.
- The concept, nature, types of social change & its significance in Education.
- The concept, nature & types of social agency.
- The role of family & School as a social agency of Education.
- The causes of Population Explosion, & Poverty.
- The role of Education in the eradication of Poverty & Population Explosion

SM-1/SM-2
EDUSMC701T / EDUSMC702T
TEACHER EDUCATION IN INDIA
(Credit:5)

- To know about concept, objectives & importance of teacher education.

- To know about the development of Teacher education in India.
- To know the concept, Functions of Pre-service & In-service Teacher Education.
- To know about Distance mode of Teacher Education.
- To know about administration of Teacher Education. • To know about Modern concept of Teacher education.

DEPARTMENT OF ENGLISH

MA-1/MB-1
ENGMIN101T
THE INDIVIDUAL & SOCIETY

COURSE OUTCOMES:

1. **Examining Social Structures and Identity:** Students will critically explore how literature engages with caste, class, gender, race, and globalization, assessing the role of individual experiences in shaping societal narratives.
2. **Interpreting Literary Responses to Injustice:** Learners will analyze texts such as *Deliverance* and *Joothan*, exploring themes of systemic oppression, resilience, and caste-based discrimination in Indian literature.
3. **Understanding Intersectionality in Literature:** Through works by Woolf, Tagore, Hughes, and Angelou, students will assess how gender, race, and identity interact in shaping personal and collective histories.
4. **Analyzing Literary Depictions of Conflict and Trauma:** Students will examine narratives surrounding war and violence, including *Dulce et Decorum Est* and *The Ghosts of Mrs. Gandhi*, to understand literature’s role in memorializing and critiquing violent histories.
5. **Exploring Globalization and Cultural Interactions:** Learners will engage with works like *At the Lahore Karhai* and *The Brand Expands*, assessing how literature reflects shifting global dynamics, cultural hybridity, and contemporary social movements.

MA-2/MB-2
ENGMIN202T
POETRY

COURSE OUTCOMES:

1. **Understanding Poetic Forms and Structures:** Students will explore major poetic genres, including epic, ballad, ode, sonnet, and elegy, identifying their defining characteristics and historical significance.
2. **Analyzing Thematic and Stylistic Elements:** Learners will engage with key poetic works, including Shakespeare’s *Sonnet 116*, Yeats’ *An Acre of Grass*, and Shelley’s *Ode to the West Wind*, examining their use of imagery, meter, and symbolism.
3. **Interpreting Narrative and Lyric Poetry:** Through the study of Keats' *La Belle Dame Sans Merci* and Poe’s *Annabel Lee*, students will assess how ballads convey emotion, narrative depth, and poetic musicality.
4. **Exploring the Influence of Epic and Mock Epic Traditions:** Students will critically engage with Milton’s *Paradise Lost* and Pope’s *The Rape of the Lock*, analyzing themes of heroism, satire, and grandeur within poetic storytelling.
5. **Developing Advanced Poetic Analysis Skills:** Learners will refine their ability to assess poetic technique, linguistic precision, and the evolving role of poetry in literary and cultural discourse.

MA-3/MB-3
ENGMIN303T/ENGCOR303T
DRAMA

COURSE OUTCOMES:

1. **Understanding the Evolution of Comedy and Tragedy:** Students will explore the historical development of European drama, analyzing key playwrights from Classical Greek, Roman, and English traditions.
2. **Examining Dramatic Structure and Theatrical Conventions:** Learners will study essential literary terms and dramatic techniques, including tragicomedy, plot construction, dramatic irony, hubris, catharsis, and Freytag's pyramid.
3. **Interpreting Themes in Modern Drama:** Students will critically engage with *Riders to the Sea* and *Arms and the Man*, assessing their treatment of realism, heroism, and socio-political commentary.
4. **Comparing Classical and Modern Playwrights:** Learners will evaluate how playwrights like Synge and Shaw adapt and transform traditional dramatic forms to reflect contemporary themes and concerns.
5. **Applying Analytical Skills to Dramatic Texts:** Students will refine their ability to assess dramatic works within historical, cultural, and theoretical contexts, enhancing their interpretative and critical perspectives.

SM-1/SM-2
ENGHSM701T
Literature and Environment

COURSE OUTCOMES:

1. **Exploring Ecocriticism and Environmental Narratives:** Students will analyze how literature engages with ecological themes, examining works like *Silent Spring* and *The Ecocriticism Reader* to understand the intersections of nature, politics, and literary representation.
2. **Interpreting Environmental Consciousness in Fiction:** Learners will study narratives from *The Call of the Wild* and *The Hungry Tide*, assessing how fiction portrays human interaction with natural landscapes, survival, and environmental challenges.
3. **Examining Poetic Expressions of Nature and Conservation:** Through poems by Blake, Wordsworth, Yeats, and Patel, students will engage with literary representations of environmental destruction, ecological beauty, and humanity's relationship with nature.
4. **Understanding Cultural and Societal Perspectives on Ecology:** Learners will critically evaluate texts such as *Environmentalism and Global History* and *Planetary Specters*, exploring how literature reflects global environmental concerns, migration, and climate change.
5. **Developing Critical and Comparative Analytical Skills:** Students will refine their ability to assess environmental literature across genres, recognizing how writers from different cultural backgrounds contribute to discussions on sustainability, activism, and ecological awareness.

DEPARTMENT OF HISTORY

MA-1/MB-1
History of India, from Earliest Times up to 300 CE

i) This paper will make students familiar with the concepts of Bharatvarsa that prevailed in early India and archaeology and literary evidences to write early Indian history. Besides it takes students to the chapter of Neolithic-Chalocolithic period with special reference to Indus Civilization, Vedic period and state formation in North India in 6th century B.C. in form of Mahajanapada.

ii) It also helps the students to take glimpse of society, religion, economy and culture up to 6th century B.C. of early India. This paper will help the students to gain knowledge about the process of 'Empire' building in India from the sixteen Mahajanapadas to the emergence of the Mauryan empire.

iii) This paper will cover the Polity, economy, society, religion and culture during the periods from the Mauryans to the Kushanas. Also, this paper concentrates on the early medieval Indian polity, socio-economic and cultural condition up to 300 CE.

MA-2/MB-2
History of India, from 300 CE to 1206 CE

i) After illuminating the political, socio-economic and cultural aspects of the Gupta period, this paper will introduce students with the concept of early-medieval in the context of Indian history.

ii) The early-medieval phase in India features regionality in the form of regional political powers which further led to the conflicts among any other in view to acquire fertile land and economic interest implied in it.

iii) Besides the nature of polity in the form of feudalism, segmentory state and integrative state has been underlined in this paper as well as the nature of various regional power especially of Chola state.

MA-3/MB-3
History of India, from 1206 CE to 1707 CE

i) This paper will cover the emergence of the Delhi Sultanate, its foundation, consolidation, expansion and challenges.

ii) It will also cover the regional states. Besides this paper will focus on the society, economy, religion and culture of the whole period.

iii) It will acquaint the students with the Mughal polity, society, economic experiments and the cultural milieu of Mughal era along with the downfall of the Mughal empire.

SM-1
History of Indian Journalism: Colonial and Post Colonial Period

i) This Paper illuminates the students with various aspects of Journalism of colonial and post-colonial India to perceive the changes in the journalism of both periods.

ii) It also makes the students acquaint about the print culture that play active role in the rise of nationalism in colonial period especially in Bengal with prominent newspapers at that time.

iii) It further teaches the students that how to write report on certain events.

SM-2
Some Perspectives on Women's Rights in India

i) This paper will help students to gain knowledge about the concept of Human-Rights, equal rights of Women, preventive acts and remedial measures for the protection of women rights, role of N.G.O. etc.

ii) Students will conscious about the issues regarding gender discrimination that are existed in the society and will enlighten about the women's empowerment.

DEPARTMENT OF POLITICAL SCIENCE

MA-1/MB-1
(PLSMIN101T)
Political Theory: Concepts
(Credit: 5)

This course is designed to develop a foundational understanding of Political Science. The first step towards learning any discipline is developing a theoretical understanding of the subject matter. The course contents shed critical light upon key political concepts and their different meanings, interpretations, and theoretical positions.

After completing this course, the students are expected to,

- develop conceptual understanding of some foundational ideas of the discipline.
- explain different approaches to politics and build their own understanding of politics.
- gain knowledge and assess the role and functions of political theory.
- develop abilities to answer why the state plays occupies a central place in the discourses on politics and make crucial conceptual distinctions for instance, between nation and state.
- learn about power and how operates in society and politics.
- be acquainted with the contemporary debates on key concepts like equality, freedom, democracy, citizenship, and justice, thereby developing a critical understanding of the expanding horizons of discourses in the discipline.

MA-2/MB-2
(PLSMIN202T)
(Credit: 5)
Indian Constitution and Government

Effective, aware, and active citizenship requires a working knowledge of the political system to which one belongs along with a clear understanding of one's rights and duties as a citizen. Working of a political system depends on constitutional and extra-constitutional institutions along with forces that shape the functioning of the government and political system. This paper exposes the students to the formal-structural, constitutional side by providing a clear idea of the basics of the Constitution of India by picking some fundamental themes and core institutions which are essential to understand the core philosophy and the ideals of Indian constitution, the functioning of the government apart from the framework in which the polity operates.

After completing this course, the students are expected to,

- gain objective knowledge about constitutionalism in the Indian context through the function of the various organs of the government and their interrelationships.
- know the evolution of Indian Constitution and internalize its core philosophy and ideals as enshrined in the Preamble.
- develop awareness on Fundamental Rights, how these rights are different from the Directive Principles of the State Policy and their duties as citizens of the country.
- have the knowledge and ability to explain the structures, powers, and functions of three organs of government and their mutual relationship and engagements.
- assess and analyses the federal structure of the Indian government and the emerging trends in center-state relations as part of everyday politics.

Apart from building aware future citizens of the country, this course also aims at preparing the learners for a career in academics, legal professions, administrative services, media and various civil society organizations.

MA-3/MB-3
(PLSMIN303T)
Comparative Government and Politics
(Credit: 5)

Comparison is crucial for explanation and analysis and is also a natural human instinct. Our understanding of 'self' is conditioned largely in relation to another. Drawing on this perspective, the objective of the course is to make the students comparatively understand and assess the constitutional structures and political processes of different types of states around the world. Also, a political system does not operate in vacuum but within a legal, economic, socio-political, and cultural ambience. This course exposes the students to understand concepts and approaches which can be applied for understanding different political regimes in terms of governmental structures and their functioning in their context thereby enabling contextual comparison as well.

After completing this course, the students are expected to,

- develop an idea of comparative politics and its nature, scope and tools of comparison.
- learn about different types of political systems and their characteristic features.
- critically understand and compare the structure and functions of the organs of government of various countries like UK, USA, PRC, France.
- develop a comprehensive understanding of different types of regimes thereby sharpening skills and aptitude for research.

SM 1
(PLSSMC701T)
International Relations: Indian Foreign Policy
Credit: 5

The objective of the course is to familiarize the students with the key aspects of Indian Foreign Policy. It highlights India's relations with big powers as well as regional powers. A critical understanding of India's role at the global and regional level is expected to orient students towards careers related to foreign policy-making.

After completing this course, the students are expected to

- Understand the different determinants of foreign policy of India.
- Know the core principles of Indian foreign policy.
- Know the relationship of India with major powers as well as neighboring countries.
- Know the role of India with regional organizations.

SM 2
(PLSSMC702T)
Politics in India: Structures and Processes
Credit: 5

The objective of the course is to familiarise students with the political processes of India and enable them to critically assess the same. On completion of the course, students are expected to have critical knowledge of political parties, party systems, electoral processes, and identity politics in India.

After completing this course, the students are expected to,

- develop the ability to explain and analyse the ideology, structure, social base and functioning of the key political parties playing the pivotal role in the democratic polity of India and also gain insights into transition from one party dominant system to coalition politics over the years.
- gain an idea of the electoral process in India.
- critically examine the role of various drivers of Indian identity politics like caste, tribe, religion, language etc.

- develop ideas regarding role of various classes like working class, peasants etc. in Indian politics and how their actions have shaped political agenda across decades.
- critically analyse the various movements related to women, environment and human rights that have shaped the political scenario as we see today.
- Critically assess the role of media as the fourth pillar of Indian democracy.

DEPARTMENT OF ANTHROPOLOGY

MA-1/MB-1
ANTMIN101T
INTRODUCTION TO ANTHROPOLOGY – I

Course Outcomes:

1. **Comprehensive Understanding of Anthropology**: Students will be able to define anthropology, articulate its historical development from both global and Indian perspectives, and explain key concepts such as holism, cultural relativism, and the importance of cross-cultural comparison and fieldwork.
2. **Biological Anthropology Insights**: Students will demonstrate knowledge of human evolution, including the biological and cultural factors that influence it, and will be able to discuss the principles of evolution and the classification and characteristics of living primates, highlighting their evolutionary trends and socio-ecological contexts.
3. **Archaeological Methodology and Cultural Stages**: Students will understand the methods and approaches in archaeological anthropology, including exploration, excavation, and dating techniques, and will be able to outline the cultural stages of prehistory, including identifying and describing various stone and bone tools from these periods.
4. **Social and Cultural Dynamics**: Students will be equipped to analyze fundamental concepts of social and cultural anthropology, such as social structure, kinship, and marriage systems, and will be able to critically assess how these elements shape societies and cultural identities across different contexts.
5. **Skeletal Identification Proficiency**: Students will demonstrate the ability to accurately identify and describe the human skeleton's features, including cranial and postcranial bones, and will apply anatomical knowledge to determine sex from skeletal remains, focusing on specific bones such as the skull and pelvic girdle.
6. **Anthropoid Skull Analysis**: Students will develop skills in identifying and comparing the skulls of various anthropoid species, including Gibbons, Orangutans, Gorillas, and Chimpanzees, utilizing models or photographs to enhance their understanding of anatomical differences and evolutionary significance.
7. **Tool Typology and Functionality**: Students will be able to classify and analyze various prehistoric tools by identifying their typotechnological attributes, understanding their cultural contexts, and illustrating the methods of hafting and tool function, while effectively drawing and labeling tools from different prehistoric periods.

MA-2/MB-2
ANTMIN202T
INTRODUCTION TO ANTHROPOLOGY – II

Course Outcomes:

1. **Understanding Hominid Evolution**: Students will be able to describe the phylogenetic status,

characteristics, and geographical distribution of key hominid species, from Tertiary hominoids to anatomically modern Homo sapiens, highlighting their evolutionary significance and adaptation.

2. **Human Variation and Genetics**: Students will demonstrate an understanding of the biological basis of human variation, including Mendelian inheritance and racial classifications, and will be able to critically analyze the implications of race and racism in contemporary society based on genetic and morphological data.
3. **Economic Anthropology Framework**: Students will explore the meaning, scope, and relevance of economic anthropology, identify different means of subsistence, and understand the principles governing production, distribution, and exchange within various cultural contexts.
4. **Political and Religious Organization**: Students will be able to define and differentiate between various forms of political organization (band, tribe, chiefdom, state) and understand key concepts related to power, authority, and legitimacy. Additionally, they will analyze anthropological approaches to religion, recognizing different belief systems and the roles of religious specialists in various cultures.
5. **Identification and Classification of Extinct Hominids**: Students will demonstrate the ability to accurately identify and classify key extinct hominid species, such as Australopithecus africanus and Homo sapiens neanderthalensis, through the examination of casts, models, or photographs, highlighting their morphological features and evolutionary significance.
6. **Anthroposcopic Assessment Skills**: Students will develop skills in anthroposcopy by performing detailed observations of physical traits in human participants, including assessments of skin color, hair type, and ear characteristics, enabling them to understand human variation and its implications.
7. **Craniometric Measurement Proficiency**: Students will gain hands-on experience in craniometry by conducting precise measurements of human skulls, such as cranial length and facial height, allowing them to analyze and interpret cranial variation and its relationship to population diversity.
8. **Data Collection and Reporting**: Students will learn to prepare comprehensive project reports through data collection and analysis of at least 10 families in their area of residence, and will conduct a case study on significant life events, enhancing their research skills and understanding of anthropological fieldwork methods.

MA-3/MB-3
ANTMIN303T
FUNDAMENTALS OF ANTHROPOLOGY– I

Course Outcomes:

1. **Understanding Human Evolution and Adaptation**: Students will be able to explain the process of hominization, emphasizing key adaptations such as cranial capacity, bipedalism, and manual dexterity, and will analyze the interplay between biological and cultural evolution in human history.
2. **Ecological Concepts and Human Populations**: Students will demonstrate knowledge of ecological principles, including autecology and synecology, and will apply ecological rules (such as Allen's, Bergman's, and Gloger's rules) to understand human adaptation to diverse environments and ecological stressors.
3. **Prehistoric Cultures and Artifacts**: Students will explore world prehistory by identifying and analyzing key archaeological cultures, including Oldowan and Acheulian tools in Africa, as well as Palaeolithic, Mesolithic, and Neolithic cultures in Europe and India, and will assess the significance of prehistoric art.
4. **Cultural Concepts and Tribal Dynamics**: Students will critically examine definitions and attributes of culture as proposed by key anthropologists, explore the concept of tribe in social

organization, and analyze the material culture and social structures of specific Indian tribes, including their regional and economic contexts.

5. **Craniometric Measurement Skills**: Students will demonstrate proficiency in craniometry by accurately conducting direct measurements of various linear dimensions, indices, chords, and circumferences on human skulls, enabling them to analyze and interpret cranial variation and its implications for understanding human evolution and diversity.
6. **Cultural Presentation and Analysis**: Students will prepare and deliver a comprehensive PowerPoint presentation on the material culture and social organization of a selected Indian tribe, developing skills in research, synthesis of information, and effective communication, while engaging in discussion and critique to enhance their understanding of cultural anthropology.

SM-1
ANTSMC701T
FUNDAMENTALS OF ANTHROPOLOGY– II

Course Outcomes:

1. **Understanding Genetic Variation and Population Dynamics**: Students will be able to explain the sources of genetic variation in human populations, including concepts such as mutation, gene flow, and genetic drift, and will analyze intra- and inter- population variation using markers like polymorphic and molecular markers, demonstrating an understanding of typological, populational, and clinal classification models.
2. **Human Growth and Development**: Students will gain insight into the stages of human growth and maturation, articulating the cellular processes involved in development and distinguishing between the prenatal and postnatal stages, which will enhance their comprehension of biological anthropology and its implications for human health and adaptation.
3. **Cultural Evolution and Theoretical Frameworks**: Students will critically assess key theoretical frameworks in social-cultural anthropology, including evolutionism, neo-evolutionism, and diffusionism, and will evaluate the contributions of major theorists such as E.B. Tylor, L.H. Morgan, and Franz Boas, fostering a deeper understanding of how these theories shape the study of culture and society.
4. **Anthropometric Measurement Proficiency**: Students will demonstrate the ability to accurately conduct and analyze anthropometric measurements on at least ten subjects, including head circumference, body weight, and various indices (e.g., Cephalic Index and Body Mass Index), enabling them to assess and interpret human physical variation and its implications for health and population studies.
5. **Analytical Report on Harappan Civilization**: Students will prepare a comprehensive report on the Harappan Civilization, focusing on its geographical, historical, and cultural significance. This report will include a detailed map illustrating major sites, and will emphasize critical aspects such as urban planning, economy, or society, fostering skills in research, critical analysis, and effective communication of anthropological concepts.

SM-2
ANTSMC702T
FUNDAMENTALS OF ANTHROPOLOGY– III

Course Outcomes:

1. **Understanding Human Genetics**: Students will be able to explain the historical development and major milestones in human genetics, describe the various methodologies used in the field,

and identify patterns of inheritance and chromosomal aberrations, enhancing their understanding of genetic variation and its implications for human health.

2. **Analyzing Archaeological Cultures**: Students will demonstrate knowledge of key archaeological cultures related to the Iron Age and the second urbanization in India, including the characteristics of various ware cultures and megalithic burial types, and will appreciate the importance of preserving cultural heritage through critical discussions of preservation methods.
3. **Cultural Ecology and Human Adaptation**: Students will analyze the concept of cultural ecology and its application to human adaptation across different subsistence strategies, assessing how ecological themes contribute to state formation and social organization, thereby integrating anthropological perspectives with environmental factors in shaping human societies.
4. **Dermatoglyphic Analysis Skills**: Students will be able to identify and classify different finger and palmar dermatoglyphic patterns, calculate the Pattern Intensity Index, and analyze triradii and main line formulas, enhancing their understanding of the genetic and environmental factors influencing fingerprint characteristics.
5. **Cultural and Historical Insight from Visits**: Students will develop the ability to prepare comprehensive reports based on observations from museum and heritage site visits, demonstrating an understanding of historical artifacts and their cultural significance while reflecting on personal learning experiences and community engagement with cultural heritage.

DEPARTMENT OF BOTANY

MA-1/MB-1
BOTMIN101T/101P
Biodiversity (Microbes, Algae, Fungi and Archegoniate)

After successful completion of theoretical and practical courses students will be able to understand –

1. General and structural features, replication (general account), types of Viruses, Lytic and lysogenic cycle, economic importance.
2. General and structural features, reproduction (vegetative, asexual and recombination), economic importance of bacteria.
3. General characteristics; ecology and distribution; range of thallus organization and reproduction; classification, economic importance, and life cycle pattern of algae.
4. General characteristics, ecology, range of thallus organization, cell wall composition, nutrition, reproduction and classification, life cycle pattern of Fungi, symbiotic associations, Lichens and Mycorrhiza.
5. Terms & Definitions in Phytopathology, Disease & Disease Cycle, Phytoalexins, Symptoms, Causal organisms, Control measures of few plant diseases.
6. General characteristics of different Archegoniates (Bryophytes, Pteridophytes and Gymnosperms), classification, systematic position, morphology, anatomy and reproduction in different representative members, ecological and economic importance.
7. Through practical classes students would have working experience of study of vegetative and reproductive structures of various archegoniates, Gram staining of bacteria from curd sample. also study of plant various plant diseases.

MA-2/MB-2
BOTMIN202T/ 202P
Plant Ecology and Taxonomy

After successful completion of theoretical and practical courses students will be able to understand –

1. Ecological factors (Soil, water, Light and temperature), Adaptation of hydrophytes and xerophytes.
2. Plant communities, succession - processes and types, Ecosystem- energy flow, trophic organisation; food chains and food webs, Ecological pyramids; production and productivity; biogeochemical cycles.
3. Phytogeography, principle biogeographical zones, Endemism.
4. Plant taxonomy, identification, classification, nomenclature, Taxonomic hierarchy, significance of herbarium, botanical gardens.
5. Botanical nomenclature - principles, and rules (ICN); typification, author citation, effective and valid publication.
6. Classification - artificial, natural, and phylogenetic, Bentham and Hooker's system of classification, general idea of Cronquist's classification (1981).
7. Numerical taxonomy, cluster analysis, phenograms, cladograms.
8. Through practical classes students would be able to measure microclimatic variables, Study of biotic interactions, Quantitative analysis of herbaceous vegetation, Study of vegetative and floral characters of few plant families.

MA-3/MB-3
BOTMIN303T/303P
Plant Anatomy and Embryology

After successful completion of theoretical and practical courses students will be able to understand –

1. Meristematic and permanent tissues.
2. Vascular cambium and Secondary growth in root and stem, heartwood, and sapwood.
3. Adaptive and protective systems, adaptations in xerophytes and hydrophytes.
4. Structural organization of flower; Structure and types of ovules, embryo sacs, organization and ultrastructure of mature embryo sac.
5. Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.
6. Endosperm types, structure, and functions; Embryo - Dicot and monocot; Embryo endosperm relationship, Apomixis and Polyembryony.
7. After practical courses students will be able to study the different types of tissue, primary and secondary structure of stem, root, and leaf, with differential staining methods, study the reproductive structures, dissection of embryo/endosperm from developing seeds.

DEPARTMENT OF CHEMISTRY

MA-1/MB-1
CEMMIN101T/ CEMMIN101P
Chemistry-1 [Inorganic Chemistry-I, Organic Chemistry-I, Physical Chemistry-I]

This course will enrich the students with basic concepts on:

1. Bohr's theory and Sommerfield's model for atomic structure.
2. Classification of elements based on electronic configuration and their general properties.
3. Concept of relative strength of acids and bases applying different theories

4. Fundamentals concepts of bonding in Organic molecules and different electronic effects like shapes and covalent bond properties.
5. Preparations and characteristic reactions of alkane, alkene, and alkynes (up to 5 carbons)
6. Effect of pressure and temperature on ideal gas, collision theory and Maxwell distribution of speed, behaviour of real gas.
7. Definition, dimension, and principle of determination of surface tension and viscosity of liquid.

In laboratory, student will learn the following;

1. Preparation of standard solution
2. Identification of single organic compound and preparation of two organic compounds
3. Determination of relative viscosity and surface tension.

MA-2/MB-2
CEMMIN202T/ CEMMIN202P
Chemistry-2 [Inorganic Chemistry-II, Organic Chemistry-II, Physical Chemistry-II]

This course will enrich the students with basic concepts on:

1. Useful aspects of ionic including the idea of Born-Landé equation, & Born-Haber cycle, and its application.
2. Comprehensive understandings of covalent bonding including the knowledge of valence bond theory, Bent’s rule, VSEPR theory and ground state Term symbols.
3. Redox reactions and balancing of equations.
4. Stereochemistry of acyclic compounds, different projection formulas, and elements of symmetry in molecules, various configurational descriptors.
5. Aliphatic nucleophilic substitution and elimination reactions.
6. Classification of systems and functions. Different laws of thermodynamics and its application

In laboratory, student will learn the following;

1. Estimation of some common inorganic ions.
2. Systematic analysis of single organic compounds.
3. Determination of solubility product.

MA-3/MB-3
CEMMIN303T/ CEMMIN303P
Chemistry-1 [Inorganic Chemistry-III, Organic Chemistry-III, Physical Chemistry-III]

This course will enrich the students with basic concepts on:

1. Basic concepts of natural & artificial radioactivity and its useful applications in various fields.
2. Details of Molecular Orbital theory and its application on homonuclear diatomic molecules.
3. Synthesis, physical properties (boiling point, polarity, and solubility) and useful chemical reactions of alcohols and ethers.
4. Preparation of carbonyl compounds and various name reaction related to carbonyl compounds.
5. Extent of reaction, rate constant, rate, order, and molecularity.
6. Integrated rate laws for 1^{st}, 2^{nd} and n^{th} order reactions and concepts of pseudo 1^{st} order reactions.
7. Temperature dependence of rate constant and theory of rate process

In laboratory, student will learn the following;

1. Estimation of inorganic mixture and aniline.
2. Hydrolysis of benzamide
3. Determination of heat of solution

SM-1/SM-2
CEMSMC701T/CEMSMC701P
Advance Chemistry-1 [Inorganic Chemistry-7, Organic Chemistry-7, Physical Chemistry-7]

This course will enrich the students with basic concepts on:

1. Redox reaction: balancing, redox potential and standard redox potential, Nernst equation and redox titration.
2. Coordination chemistry: bonding, Werner's theory, coordination number, IUPAC nomenclature and isomerism.
3. Green chemistry: Definition, illustration, examples and atom economy, green synthesis using green solvent and alternative source of energy.
4. Conductance: Definition, variation of conductivities with dilution, Kohlrausch's law, Ostwald dilution law and transport number.
5. Electrochemical cells with examples, potentials, calculation of thermodynamics properties, liquid junction potential, determination of pH and potentiometric titration.

In laboratory, students will learn the following;

1. Qualitative analysis of inorganic samples
2. Preparation of benzylic acid and hydrolysis of methyl salicylate.
3. Conductometric titration of acid
4. Potentiometric redox titration.

DEPARTMENT OF ECONOMICS

MA-1/MB-1
ECOMIN101T
INTRODUCTORY MICROECONOMICS

Upon successful completion of this course, students will be able to-

1. Identify the factors that determine the demand for a product by a consumer and how consumer maximizes utility subject to budget constraint
2. How a business firm decides its output production in short run and long run by considering various costs of production to maximize profit
3. The characteristic features of different types of output market structure where buyers and sellers interact
4. The determination of prices of different factors of production in factor market

MA-2/MB-2
ECOMIN202T
INTRODUCTORY MACROECONOMICS

Upon successful completion of this course, students will be able to-

1. The three key macroeconomic concepts for a closed economy, namely, economic growth (and how it is measured in terms of GDP and National Income), Inflation (its different types and how it is influenced by money supply) and unemployment (how it can be present in Classical and Keynesian macroeconomic system)
2. The idea of two important component of GDP, namely, Consumption and Investment
3. The money and banking system of an economy

MA-3/MB-3
ECOMIN303T
DEVELOPMENT ECONOMICS

Upon successful completion of this course, students will be able to-
1.The distinction between growth and development, indicators of growth, concept of HDI, GDI.
2. The alternative strategies of economic development and the complementary role of agriculture and industry in economic development.
3. The relationship between population and economic development; the role and problems of domestic capital formation and foreign investment.
4. Role of different international institutions like IMF, World Bank and WTO in economic development of developing nations.
5. Nature and extent of gender discrimination in the society.

DEPARTMENT OF GEOGRAPHY

MA-1/MB-1
GEOHM01T
PHYSICAL GEOGRAPPHY
(Credit:5)

Learning Outcomes

- With an emphasis on the Earth's interior and the main forces sculpting its surface, this course explores geotectonics.
- Through an examination of lithological influences, landform-regulating factors, and other exogenetic processes, this course provides a grasp of physical geography and the basic concepts of geomorphology.
- The students get an awareness of the possible threat of a hazard or disaster and understand the key tactics of significant operations.
- Through the study of ecosystems, biomes, atmospheric creation, planetary wind systems, and soil formation, this course offers a knowledge of biogeography and climatology.

Broad Content

- Internal Structure of Earth
- Influence of lithology and factor controlling landforms development
- Evolution of landforms
- Nature and classification of hazard
- Brief encounter of atmosphere and concept of wind system
- Formation and factor of soil
- Concept ecosystem and biomes

MA-2/MB-2
GEOHM02T
HUMAN GEOGRAPPHY
(Credit:5)

Learning Outcomes

- By discussing the political, economic, and environmental facets of regional development, ethnic diversity, and societal processes, this article aids students in understanding these topics.

- A fundamental grasp of population density, distribution, growth rate, and demographic transition theory is given in this course.
- Understanding the development of human civilizations and how they have adapted to nature is made easier by this unit.
- The distribution, layout, trends, and classification of India's urban and rural settlements are all covered in this course.

Broad Content

- Elements and Approaches in human geography
- Evolution of human societies and their adaption to environment
- World population
- Demographic Transition Theory
- Classification of Economic Sectors
- Types of Agriculture
- Urban and Rural settlement

MA-3/MB-3

GEOHM03T

GENERAL CARTOGRAPHY

(Credit:5, Theory-3, Practical-2)

Learning Outcomes

- Students will gain knowledge about map scale, including its varieties and uses, as well as how to effectively read distances on a map.
- The fundamental idea of map projections, how to select them according to the qualities they maintain, the unique features of types such as Zenithal, Cylindrical Equal Area, Mercator, and Bonne's, and the UTM projection system will all be covered for the students.
- Students will learn how to read all of the important information on the margins of Survey of India topographical maps, including their old and Open Series reference systems.
- Students may learn how to read these thematic maps and how to depict data on them using symbols, dots, choropleth, isopleth, and flow diagrams.

In the laboratory students will acquire

- The ability to visually create simple and comparable map scales for precise distance measuring is taught to students.
- For some map projections, such as Mercator's, Bonne's, Cylindrical Equal Area, Zenithal Gnomonic Polar, and Zenithal Stereographic Polar, students study the mathematical and graphical building techniques.
- Through the use of Survey of India topographical maps, students will learn how to create and analyze relief profiles (superimposed, projected, and composite), relative relief maps, and slope maps. They will also learn how to use transect charts to link physical and cultural characteristics.

Broad Content

- Concept of map scale: Types and Application. Reading distances on a map
- Map Projections: Criteria for choice of projections. Attributes and properties of: Zenithal Gnomonic Polar Case, Zenithal Stereographic Polar Case, Cylindrical Equal Area, Mercator’s Projection, Bonne’s Projection. Concept of UTM projection
- Survey of India topographical maps: Reference scheme of old and open series. Information on the margin of maps
- Representation of Data – Symbols, Dots, Choropleth, Isopleth and Flow Diagrams, Interpretation of Thematic Maps

SM-1/SM-2
GEOHSMP

(PROJECT REPORT BASED ON FIELD WORK)

(Credit:5, Practical-4, Practical-1)

Learning Outcomes

- Project work indeed provides opportunities to the candidates to learn beyond the textbooks, seeing the geographical laws in real time, handling the primary objective of data procurement methods as well as understand the interrelation of socio-economic situations and enhancing their skills on door-to-door communication, report-writing, surveying alongside with various cartography technique.
- Field work often associates with land analyzing and mapping system. So, by enrolment of student, it helps them to understand the GIS analyzing process and improve their data sorting and data interpretation skills.
- Report-writing needs skills like hypothesis testing, problem formulation methods etc. By doing it, students may develop their paragraphing skill, develop report presenting and learn basic report-book making.
- All types of cartography techniques, map references, excluding figures, photograph, using of diagrams, tables, and appendices.
- With some basic rules & regulation like, report excluding in 8000 words, conducting the field in 10 days, report may be completed in 20 to 25 pages all in A4 size pages. These features help to build a disciplinary nature inside of a student.

Broad Content

- Data Procurement
- Data Collection
- Data Management
- Data Analysis
- Data Interpretation
- Primary report building

DEPARTMENT OF MATHEMATICS

MA-1/MB-1
MTMMIN101T
Algebra
(Credits: 5)

1. Understand and apply De Moivre’s Theorem to raise complex numbers to integer and rational powers in polar form.

2. Visualize and interpret geometric representations of complex roots on the Argand diagram (e.g., n-th roots of unity forming regular polygons).
3. Analyse the behaviour and graph of polynomial functions, including end behaviour, turning points, and symmetry.
4. Solve higher-degree polynomial equations and systems involving polynomials using algebraic methods.
5. Understand and apply equivalence relations and demonstrate how they lead to natural partitions of a set.
6. Establish one-to-one correspondences (bijections) between sets to compare their sizes and determine cardinality, including both finite and infinite sets.
7. Identify and work with special types of matrices:
   Symmetric and skew-symmetric matrices (real entries)
   Hermitian and skew-Hermitian matrices (complex entries)
   Orthogonal matrices (real, with transpose as inverse)
   Unitary matrices (complex, with conjugate transpose as inverse)
8. Analyse the existence and uniqueness of solutions to linear systems using the determinant and rank of coefficient matrices.
9. Determine the rank of a matrix using elementary row operations, and apply relevant theoretical results without proofs.
10. Develop algorithmic problem-solving skills useful in engineering, data science, computer programming, and applied mathematics.
11. Classify and determine the nature of solutions (unique, infinitely many, or no solution) using the concept of rank.
12. Understand and construct equivalent systems of equations, preserving solution sets via elementary transformations.

MA-2/MB-2
MTMMIN202T
Calculus
(Credits: 5)

1. Understand the formal ε–δ definition of a limit and apply it to verify the limit of a function at a point.
2. Apply rules of successive differentiation and compute higher-order derivatives of algebraic, exponential, and trigonometric functions.
3. State and apply Euler's theorem for homogeneous functions and its converse to simplify expressions involving partial derivatives.
4. Develop a strong foundation in differential calculus required for applications in physics, engineering, optimization, and multivariable calculus.
5. State and apply Rolle's Theorem, Lagrange's Mean Value Theorem (LMVT), and Cauchy's Mean Value Theorem (CMVT), along with understanding their conditions and implications.
6. Apply Mean Value Theorems to derive and prove inequalities, and to study the increasing/decreasing nature of functions.
7. Understand and use Taylor's Theorem with remainder to approximate functions near a point using polynomials.
8. Integrate rational and irrational functions using appropriate substitution, algebraic simplification, and standard techniques.
9. Recognize and solve special standard integrals, including those involving trigonometric, logarithmic, and exponential functions.
10. Understand and compute Beta and Gamma functions, and apply their properties in solving definite and improper integrals.
11. Find equations of the tangent and normal to a curve at a given point and interpret their geometric significance.

12. Compute the length of a plane curve using arc length formulas in both Cartesian and parametric/polar forms.
13. Determine the curvature and radius of curvature of curves in Cartesian and polar forms.

MA-3/MB-3
MTMMIN303T
Differential Equations
(Credits: 5)

1. Solve first-order exact differential equations and apply methods to find integrating factors.
2. Analyse and solve higher-degree first-order ODEs solvable for x, y, p
3. Identify and interpret singular solutions of differential equations.
4. Understand the basic theory of linear ODEs, including the concept of linear independence, the Wronskian, and techniques to reduce the order of a linear ODE.
5. Formulate and solve systems of first-order linear differential equations.
6. Solve linear homogeneous and non-homogeneous ODEs with constant coefficients.
7. Use methods like complementary function, particular integrals, and variation of parameters.
8. Solve the Cauchy-Euler equations and simultaneous differential equations.
9. Solve total differential equations and understand the conditions of exactness.
10. Determine the order and degree of a PDE and classify first-order equations as linear, semi-linear, quasi-linear, or non-linear.
11. Form PDEs by:
12. Eliminating arbitrary constants,
13. Eliminating arbitrary functions.
14. Solve quasi-linear first-order PDEs using Lagrange's method.
15. Classify second-order linear PDEs into elliptic, parabolic, or hyperbolic types.
16. Reduce second-order PDEs to canonical form using illustrative examples.
17. Understand and recognize the physical and mathematical significance of the classification.

SM-1/SM-2
MTMSMC701T
Discrete Mathematics
(Credits: 5)

1. Understand the foundational concepts of propositions, truth tables, and logical operators (negation, conjunction, and disjunction).
2. Analyse and construct logical expressions involving implication, biconditional, converse, contrapositive, and inverse statements.
3. Apply Huntington postulates and De Morgan's laws to Boolean expressions.
4. Analyse Boolean expressions using truth tables and convert them to normal forms (SOP, POS).
5. Simplify Boolean functions using Karnaugh Maps and Quine-McCuskey method.
6. Define and differentiate between undirected and directed graphs and represent them geometrically.
7. Apply Euler's handshaking lemma and understand the basic properties of graphs.
8. Classify and analyse walks, trails, paths, circuits, and cycles.
9. Identify connected and disconnected graphs, components, complete graphs, and complementary graphs.
10. Solve problems involving Eulerian and Hamiltonian paths and circuits, including the Königsberg Bridge Problem.

DEPARTMENT OF MICROBIOLOGY

MA-1/MB-1
Microbial diversity & its application

1. Student will be able to describe the classification of bacteria based on their modes of nutrition, and the diverse physiological types of bacteria as determined by variable environmental factors.
2. They will be able to describe the fundamental concepts and terminology of taxonomic organization and parameters used in classifying bacteria.
3. They will be able to describe the major groups of archaea, their stand-out physiological and structural features, as well as their ecological niches and economic significance.
4. They will be able to demonstrate bacteria count by serial dilution and identify different types of bacteria using various media.
5. They will be able to analyze bacteria microscopically using various staining methods.

MA-2/MB-2
Microbes in Environment

1. This course typically aims to equip students with an understanding of microorganisms' roles and impacts within ecosystems, including their beneficial and harmful effects, and how they influence biogeochemical cycles.
2. Students will also learn about microbial interactions, environmental microbiology techniques, and the potential of using microbes for bioremediation and biotechnology applications.

MA-3/MB-3
Industrial & Food Microbiology

1. After completing the Applied Industrial Microbiology course, students will be able to: Apply various methods for their isolation, detection and identification of microorganisms in industries.
2. Practice the theories and principles of industrial microbiology in practical, real-world situations and problems.
3. Describe the fundamentals of probiotic technology and the possibility of its commercialization.
4. Categorize the different sources of probiotics along with their uses.
5. Assess the various beneficial bacteria and their interaction with food, Interpret the biochemical and molecular mechanisms of probiotics.
6. Explore the various applications of probiotics in disease prevention and management.
7. They will get opportunities to work as scientist in different food and beverages industries, Pharma industries etc.

SM-1/SM-2
Environmental Biotechnology

1. A course in Environmental Biotechnology aims to equip students with the knowledge and skills to address environmental challenges using biological systems.
2. Key outcomes include understanding how microorganisms and enzymes can be used for bioremediation, waste treatment, and pollution control.
3. Students will also learn about the application of biotechnology in areas like biofuel production, biofertilizer and biopesticide development, and environmental monitoring.

DEPARTMENT OF PHYSICS

MA-1/MB-1
PHSMIN101T/ PHSMIN101P
Mechanics PHSMIN101
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

After going through the course, the student should be able to

Understand the role of vectors and 1st and 2nd order differential equation in Physics.

Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.

Explain the conservation of energy, momentum, angular momentum and apply them to basic problems.

Apply Kepler's law to describe the motion of planets and satellite in circular orbit.

Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.

Understand elasticity a basic property of material and its importance.

In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, vernier callipers, travelling microscope) student shall embark on verifying various principles learnt in theory. Measuring 'g' using Bar Pendulum, Kater's pendulum and measuring elastic constants of materials, viscous properties of liquids etc.

(ii) Broad contents of the course:

Vectors
Ordinary Differential Equations
Laws of Motion
Momentum and Energy
Rotational Motion
Gravitation
Oscillations
Elasticity

(iii) Skills to be learned:

Learn basic mathematics like vectors and ordinary different equation and to understand linear and rotational motion.

Learn basics of Newtonian gravitation theory and central force problem.

Learn basic ideas about mechanical oscillators.

Learn elasticity and elastic constants of material and perform experiments to study them.

MA-2/MB-2
PHSMIN202T/ PHSMIN202P
Electricity and Magnetism
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

After going through the course, the student should be able to

Demonstrate Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.

Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.

Apply Gauss's law of electrostatics to solve a variety of problems.

Articulate knowledge of electric current, resistance, and capacitance in terms of electric field and electric potential.

Demonstrate a working understanding of capacitors.

Describe the magnetic field produced by electric currents.

Learn how different type of magnetism is produced in different materials.

Apply Kirchhoff's rules to analyse AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.

Apply various network theorems such as Superposition Theorem, Thevenin Theorem, Norton Theorem, Reciprocity Theorem, Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.

In the laboratory course the student will get an opportunity to verify all the above-mentioned theorems elaborated above, using simple electric circuits.

(ii) Broad contents of the course:

Vector Analysis

Electro statistics

Magnetism

Electromagnetic Induction

Linear Network

(iii) Skills to be learned:

This course will help in understanding basic concepts of electricity and magnetism and their applications.

Basic course in electrostatics will equips the student with required prerequisites to understand electrodynamics phenomena.

Develop skill of electrical network analysis which has daily application in households.

MA-3/MB-3

PHSMIN303T/ PHSMIN303P

Fluids and Waves

(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

This course will enable the student to

Understand the principle of superposition of waves, so thus describe the formation of standing waves.

Understand two of the basic properties of fluids namely surface tension and viscosity to demonstrate their effect in various circumstances.

Apply basic knowledge of principles and theories about the behaviour of light and the physical environment to conduct experiments.

Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.

Use the principles of wave motion and superposition to explain the Physics of polarisation, interference and diffraction.

Understand the working of selected optical instruments like biprism, interferometer, diffraction grating, and holograms.

In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using grating, Newton Rings experiment, etc. Resolving power of optical equipment can be learnt firsthand.

The motion of coupled oscillators, study of Lissajous figures and behavior of transverse, longitudinal waves can be learnt in this laboratory course.

(ii) Broad contents of the course:

Surface tension and viscosity.
Superposition of Two Collinear Harmonic Oscillations
Superposition of Two Perpendicular Harmonic Oscillations
Superposition of Two Harmonics Waves
Wave Optics
Interference
Michelson's Interferometer
Diffraction
Fraunhofer Diffraction
Fresnel Diffraction
Polarization

(iii) Skills to be learned:

This course in basics of optics will enable the student to understand various wave and optical phenomena, principles, workings, and applications in optical instruments.

He / she shall develop an understanding of Waves Motion and its properties.

SM-1/SM-2
PHSSMC01T/ PHSSMC01P
Solid State Physics
(Credits: 05, Theory-03, Practicals-02)

(i) Course learning outcome:

Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.

Know the statistical behaviour of system of particles.

The student is expected to learn a brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.

Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.

Free electron theory of metals, conductivity, and Hall effect.

Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.

Acquire knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss.

Understand the basic idea about superconductors and their classifications.

To carry out experiments based on the theory that they have learned to measure the magnetic susceptibility, trace hysteresis loop. They will also employ to four probe methods to measure electrical conductivity and the hall set up to determine the hall coefficient of a semiconductor.

(ii) Broad contents of the course:

Elements of Modern Physics
Crystal Structure
Elementary Lattice Dynamics
Free electron theory of Metals
Elementary band theory
Magnetic Properties of Matter
Superconductivity

(i) Skills to be learned

Learn basics of crystal structure and physics of lattice dynamics

Learn the physics of different types of material like magnetic materials, dielectric materials, metals and their properties.

Understand the physics of insulators, semiconductor and conductors with special emphasis on the elementary band theory of semiconductors.

Comprehend the basic theory of superconductors. Type I and II superconductors, their properties.

DEPARTMENT OF STATISTICS

MA-1/MB-1
STSMIN101T & STSMIN101P
Descriptive Statistics-I and Probability-I

At the end of this course a student should be able to understand

1. Different types of data and the art of data handling.
2. The techniques of summarization and identification of the salient features of the data through graphical displays and other descriptive measures.
3. The salient features of metric data related to a single variable
4. different definitions and meaning of Probability.
5. Know different laws of probability and the theorems connecting them.
6. Be able to apply the laws of probability.
7. Know the notion of conditional probability.

MA-2/MB-2
STSMIN202T & STSMIN202P
Descriptive Statistics-II and Probability-II

At the end of the course a student should understand

1. The salient features of metric data related to two variables
2. Association between two variables
3. Association between two attributes
4. Understand what is a random variable and its probability distribution.
5. Understand different aspects of univariate discrete probability distribution.

MA-3/MB-3
STSMIN303T & STSMIN303P
Survey Sampling

At the end of the course a student should understand

1. Draw random sample from a closed finite homogeneous population.
2. Estimate different population parameters along with their error of estimate
3. Draw sample from a large heterogeneous population and subsequent estimation process based on that sample.
4. Different optimization technique for drawing samples from different segments of a population within a limited resource.
5. Designing complex survey with samples drawn in multiple stages and getting subsequent estimates.

SM-1

STSSMC701T

Research Methodology in Statistics

At the end of the course a student should understand

1. Different types of data and the art of data handling.
2. The techniques of summarization and identification of the salient features of the data through graphical displays and other descriptive measures.
3. The salient features of metric data related to variables
4. How to write a dissertation and present a statistical report
5. The need of hands-on training to the students to deal with data emanating from some real life situations

SM-2

STSSMC702T

Advanced Statistical Inference

At the end of the course a student should understand

1. Basics of hypothesis testing
2. Type I and type II error
3. Critical region and p value
4. Analysis of variance for one way and two way classified data
5. Analysis of covariance for one way and two way classified data
6. Design of experiments and different types of models

DEPARTMENT OF ZOOLOGY

MA-1/MB-1

ZOOMIN101T & ZOOMIN101P

Animal Diversity Theory & Lab

1. The student will gain a basic understanding of the animal kingdom.
2. Enough to assist in species identification, serve as a keeper of animal specimens, and instruct in schools.
3. As an assistant, the student will be able to help with the research.

MA-2/MB-2

ZOOMIN202T & ZOOMIN202P

Physiology and Biochemistry Theory & Lab

1. The knowledge will be at the entry-level graduate level, sufficient to teach in classrooms, serve as a caretaker for animal specimens, and aid in species identification.
2. Students who are exposed to practical classes will be able to carry out the designated routine laboratory procedures. As an assistant, the student will be able to help with the research.

MA-3/MB-3

ZOOMIN303T & ZOOMIN303P

Insect, Vectors & Diseases Theory & Lab

1. In our nation, insect biology is very important and of considerable interest. To manage vector-borne diseases, entomologists are being sought out in rural regions to carry out surveys and

awareness campaigns.

2. They might be able to assist with these surveys thanks to this understanding. The information can be applied to widespread awareness campaigns.

SM-1/SM-2
ZOOSMC701T & ZOOSMC701P
Ecology and Evolution Theory & Lab

1. Students would be able to recognize the connections between the distribution and abundance of natural organisms.
2. Students will learn about the range of interactions that organisms have with their biological and physical surroundings.
3. They would be able to assess how the habitat influences species distribution and abundance and examine relationships within the framework of habitats.
4. By the end of the course, students will also have a general understanding of evolution and be familiar with the molecular, population genetic, and morphological approaches to understanding evolution.
5. In addition to being able to analyze, compare, and explain evolutionary trends, students will gain abilities in developing evolutionary thinking.