# SYLLABUS FOR ALL POST CODES

**Part-A for all the Posts**

- **General English**-vocabulary, grammar, sentence structure, synonyms, antonyms and its correct usage, Sentence Correction, Direct & Indirect Speech, Active & Passive Voice, etc.
- **General Knowledge**-India and its Neighbouring countries, Sports, History, Culture, Geography, Economic scene, General Polity including Indian Constitution, and Scientific Research, current events, Questions on Oil India Limited

**Part-B for all the Posts**

- **Reasoning & Mental Ability** - analogies, similarities and differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discriminating observation, blood relations, verbal and figure classification, non-verbal series, seating arrangements, puzzles, inequalities, syllogism, order and ranking, distance & direction, alphanumeric series etc.
- **Knowledge on Computer Application** - The questions on basic computer knowledge will be from Characteristics of Computers, Computer Organisation including RAM, ROM, File System, Input Devices, Computer Software-Relationship between Hardware and Software, Operating System, MS-Office (exposure of Word, Excel/spread sheet, Power point).

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# B.Ed Syllabus

## 1. Foundations of Education

Theme 1: Education as an Evolving Concept
- Meaning of Education: ancient to modern
- Changing concepts: School, Curriculum, Teacher, Learner
- Aims of Education: Individual, Social, Vocational, Liberal, Constitutional, Global

Theme 2: Philosophical Foundation of Education
- Philosophy-Education relationship
- Idealism, Naturalism, Pragmatism
- Thinkers: Gandhi, Dewey, Tagore, Rousseau, Sankardev

Theme 3: Socio-Cultural Foundation
- Social Stratification, Social Mobility, Culture transmission

Theme 4: Socio-Economic Foundation
- Development goals, Education & Economic Growth, HRD, LPG

Theme 5: Political Interface with Education
- Education as public policy, PPP, funding, state/central roles

## 2. Learner and Development

Theme 1: Growth and Development
- Development stages and characteristics, Influences

Theme 2: Understanding the Learner
- Intelligence types, Cultural capital, Grouping

Theme 3: Characteristics Affecting Learning
- Maturation, Motivation, Socio-cultural context, Group dynamics

Theme 4: Problems and Facilitation
- Personality, Adjustment, Mental Health

Theme 5: Guidance and Counselling
- Nature, Types, Tools, Teacher’s Role

## 3. Learning and Teaching

Theme 1: Learning as a Process
- Socio-cultural (Erickson), Cognitive (Piaget), Constructivist (Vygotsky), Lateral (de Bono), Concept formation (Bruner)

Theme 2: Learning Contexts
- Schooling limitations, Community-based learning

Theme 3: Teaching Processes
- Phases of Teaching, Strategies (Expository, Inquiry), Teaching styles

Theme 4: Teacher's Professional Identity
- Motivation, Ethics, Collaboration

Theme 5: Learning Resources
- Print, Audio-Visual, ICT, Group learning resources

**4. Contemporary India and Education**

Theme 1: Constitutional Provisions for Education
- Articles: 45, 15, 17, 28, 29, 30, 350A/B

Theme 2: Social Diversity and Marginalization
- Inequality, Gender, Disability, School type differences

Theme 3: Education Policy Pre-Independence
- Macaulay's Minute, Wood's Dispatch, Basic Education

Theme 4: Education Policy Post-Independence
- Secondary Education Commission, Kothari Commission, NPE 1986, SSA, RMSA, RTE

Theme 5: Emerging Perspectives
- Quality indicators, Peace and Environmental Education, Human Rights

**5. Assessment and Evaluation**

Theme 1: Foundations of Assessment
- Definitions, Principles, Types (Diagnostic, Summative, Formative, NRT, CRT)

Theme 2: Assessment for Learning
- CCE, Group assessments, Portfolios, Peer/Self-evaluation

Theme 3: Test Construction and Reporting
- Bloom's Taxonomy, Question Paper Design, Blueprints, Report formats

Theme 4: Emerging Trends
- Grading vs Marks, Online Exams, NCF-2005 views

**6. Pedagogical Content Knowledge**

Focus Areas:
- Subject-specific pedagogy
- Curriculum content analysis
- Instructional strategies
- Lesson planning
- Evaluation techniques

- Advanced content pedagogy
- Integrating ICT in subject teaching
- Remedial and enrichment strategies
- Action research in pedagogy

**7. School Organisation and Management**

Theme 1: Concept of School Organization
- School as a system, objectives, principles

Theme 2: Educational Planning

- Institutional Planning, Budgeting

Theme 3: Leadership and Supervision
- Democratic leadership, Academic Supervision

Theme 4: School Records and Time Management
- Logbooks, Registers, Timetabling

Theme 5: Community Involvement
- School-community relationships, PTA

**8. Inclusive Education**

Theme 1: Concept of Inclusion
- Difference from Integration, Barriers to Inclusion

Theme 2: Inclusive Strategies
- Curriculum adaptation, UDL, Assistive Technology

Theme 3: Role of Teachers and Institutions
- Collaboration with parents, peers, community

**9. Gender, School and Society**

Theme 1: Gender as a Social Construct
- Patriarchy, Stereotyping

Theme 2: Gender and Education
- Curriculum, Textbooks, Teacher Biases

Theme 3: Schooling Practices
- Gender-sensitive pedagogy, Safe spaces

**10. Creating an Inclusive School**

Theme 1: School Readiness
- Physical and social preparation

Theme 2: Teaching Strategies
- Differentiated Instruction, Cooperative Learning

Theme 3: Policy Frameworks
- RTE, RPWD Act, Inclusive policies

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**SYLLABUS FOR B.SC. (MATHEMATICS HONOURS) WITH PHYSICS AND CHEMISTRY (POST CODE: GTMA12026)**

## B.SC. (MATHEMATICS-HONOURS)

1. Calculus and Analysis
   - Calculus – hyperbolic functions, reduction formulas, conic tracing, vector functions
   - Real Analysis – sequences, series, limits, continuity, convergence tests
   - Theory of Real Functions – differentiability, mean value theorems, Taylor series
   - Riemann Integration – improper integrals, series of functions, uniform convergence
2. Algebra and Linear Algebra
   - Basic Algebra – complex numbers, functions, set theory, linear equations
   - Group Theory – group properties, subgroups, homomorphisms, Sylow theorems
   - Ring Theory – rings, ideals, polynomial rings, unique factorization
   - Linear Algebra – vector spaces, transformations, eigenvalues, inner product spaces
3. Differential Equations and Mathematical Modelling
   - Ordinary Differential Equations – linear and nonlinear, systems of ODEs
   - Partial Differential Equations – classification, methods of solutions
   - Mathematical Modelling – population, epidemiology, mechanical and electrical models
4. Numerical Methods and Computer Applications
   - Roots of equations – bisection, Newton-Raphson, interpolation techniques
   - Numerical integration and differentiation
   - Numerical solutions to ODEs – Euler and Runge-Kutta methods
5. Abstract and Applied Mathematics
   - Metric Spaces and Complex Analysis – continuity, compactness, Cauchy-Riemann equations
   - Multivariate Calculus – partial derivatives, multiple integrals, vector calculus theorems
   - Discrete Mathematics – lattices, Boolean algebra, graph theory
6. Elective and Interdisciplinary Areas
   - Number Theory – congruences, Euler's phi function, RSA encryption
   - Financial Mathematics – interest models, bonds, CAPM, IRR
   - Linear Programming – simplex method, duality, transportation and assignment problems
   - Hydro-mechanics and Mechanics – forces, pressure, conservation laws, equilibrium

## B.SC. (CHEMISTRY NON-HONOURS)

7. Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons
8. Chemical Energetics, Equilibria and Functional Group Organic Chemistry
9. Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry
10. Transition Metals, Coordination Chemistry, States of Matter and Chemical Kinetics

## B.SC. (PHYSICS NON-HONOURS)

11. Mechanics – Motion, force, energy, SHM, rotational motion, elasticity, special relativity
12. Electricity and Magnetism – Vector analysis, Gauss's and Ampere's law, electromagnetic waves
13. Thermal Physics and Statistical Mechanics – Laws of thermodynamics, entropy, kinetic theory, radiation
14. Waves and Optics – SHM, resonance, interference, diffraction, polarization
15. Digital & Analog Circuits and Instrumentation – Logic gates, semiconductors, amplifiers, CRO
16. Basic Instrumentation Skills / Computational Physics Skills
17. Elements of Modern Physics / Solid State Physics / Quantum Mechanics – Photoelectric effect, Schrödinger eqn., nuclear models
18. Renewable Energy

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**SYLLABUS FOR B.A. (ENGLISH -HONS.) (POST CODE: GTEN12026)**

1. Indian Classical Literature – Kalidasa, Vyasa, Sudraka, Sankardeva
2. European Classical Literature – Homer, Sophocles, Plautus, Ovid, Horace
3. Language, Literature & Culture
4. Indian Writing in English – R.K. Narayan, Anita Desai, Kamala Das, Nissim Ezekiel, etc.
5. British Poetry and Drama (14th–17th Century) – Chaucer, Marlowe, Shakespeare
6. Communication Skills
7. American Literature – Tennessee Williams, Toni Morrison, Edgar Allan Poe, Walt Whitman
8. Popular Literature – Lewis Carroll, Agatha Christie, Shyam Selvadurai, Bhimayana
9. Core 7: British Poetry and Drama (17th–18th Century) – Milton, Webster, Aphra Behn, Pope
10. English Language Teaching
11. British Literature (18th Century) – Congreve, Swift, Johnson, Sterne
12. British Romantic Literature – Blake, Wordsworth, Keats, Mary Shelley
13. British Literature (19th Century) – Austen, Bronte, Dickens, Tennyson, Browning
14. Contemporary India: Women and Empowerment
15. Business Communication
16. Women's Writing – Plath, Dickinson, Walker, Mahasweta Devi, Wollstonecraft
17. British Literature (Early 20th Century) – Conrad, Woolf, Yeats, Eliot
18. Modern Indian Writing in English Translation
19. Literary Criticism
20. World Literature
21. Modern European Drama – Ibsen, Brecht, Beckett, Ionesco
22. Postcolonial Literatures – Achebe, Marquez, Neruda, Walcott, Dai
23. Literary Theory
24. Partition Literature
25. Travel Writing

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**SYLLABUS FOR B.A. (HINDI HONOURS) WITH POLITICAL SCIENCE OR GEOGRAPHY OR HISTORY OR ECONOMICS OR EDUCATION (POST CODE: GTHI12026)**

**B.A (HONOURS) HINDI**

## 1. हिंदी साहित्य का इतिहास

- आदिकाल – सिद्ध, नाथ, जैन, रासो काव्य
- रीतिकाल – रीतिबद्ध, रीतिमुक्त, रीतिसिद्ध प्रवृत्तियाँ
- आधुनिक काल – छायावाद, प्रगतिवाद, प्रयोगवाद, नई कविता, गद्य विधाओं का विकास

## 2. प्रमुख काव्य परंपराएँ

- आदिकालीन एवं मध्यकालीन कवियों की रचनाएँ – विद्यापति, मीरा, कबीर, जायसी, सूर, तुलसी
- आधुनिक हिंदी कविता – भारतेन्दु, मैथिलीशरण गुप्त, जयशंकर प्रसाद, निराला, पंत, महादेवी, अज्ञेय, नागार्जुन

## 3. गद्य साहित्य

- हिंदी उपन्यास – प्रेमचंद, जैनेन्द्र, अज्ञेय, रांगेय राघव, मन्नू भंडारी
- हिंदी कहानी – चंद्रधर शर्मा गुलेरी, प्रेमचंद, यशपाल, रेणु, कृष्णा सोबती
- नाटक व एकांकी – भारतेंदु, जयशंकर प्रसाद, मोहन राकेश, विष्णु प्रभाकर
- निबंध व अन्य गद्य विधाएँ – रचनात्मक व व्यंग्य निबंध, रेखाचित्र, संस्मरण, रपट, आत्मकथा

## 4. भारतीय एवं पाश्चात्य काव्यशास्त्र

- भारतीय काव्यशास्त्र – रस, अलंकार, ध्वनि, रीति, वक्रोक्ति, औचित्य सिद्धांत
- पाश्चात्य काव्यशास्त्र – प्लेटो, अरस्तू, लोंगिनस, वर्ड्सवर्थ, कॉलरिज, टी.एस. एलियट, नई समीक्षा

## 5. भाषा विज्ञान और हिंदी भाषा

- भाषा की उत्पत्ति, विकास, देवनागरी लिपि
- ध्वनि विज्ञान, रूपविज्ञान, वाक्य विज्ञान, अर्थ विज्ञान
- हिंदी भाषा का इतिहास, बोलियाँ, मानकीकरण

## 6. प्रयोजनमूलक हिंदी और पत्रकारिता

- प्रयोजनमूलक हिंदी – कार्यालयी पत्राचार, तकनीकी हिंदी, पारिभाषिक शब्दावली
- साहित्यिक पत्रकारिता – भारतेंदु युग से समकालीन काल तक का विकास

## 7. नवीन साहित्यिक प्रवृत्तियाँ और विश्लेषण

- आलोचना, समीक्षा, उत्तर आधुनिकता, समकालीन विमर्श – स्त्री, दलित, आदिवासी

**B.A. NON-HONOURS POLITICAL SCIENCE**

8. Introduction to Political Theory – Concepts: Democracy, Liberty, Equality, Justice, Rights, Citizenship, Civil Society, Debates.
9. Indian Government and Politics – Constitution, Parliament, PM, Judiciary, Caste, Class, Religion, Movements.
10. Comparative Government and Politics – UK, USA, Canada, China, Electoral Systems, Party Systems, Globalisation.
11. Introduction to International Relations – Realism, Neo-liberalism, Cold War, India's Foreign Policy, Global Powers.

12. Themes in Comparative Political Theory – Aristotle, Locke, Marx, Gandhi, Ambedkar, Lohia, Ramabai.
13. Administration and Public Policy – Public Administration, Theories, Policy Formulation, New Public Management.
14. Reading Gandhi – Hind Swaraj, Women's Question, Anti-Racism Movements.
15. Democratic Awareness with Legal Literacy – Constitution, Rights, Gender, Criminal Law, Lok Adalats.
16. Democracy and Governance – Parliament, Judiciary, Development Models, Civil Society.
17. Understanding Globalization – UN, WTO, G-77, Global Warming, Terrorism.
18. Human Rights, Gender and Environment – Inequality, Citizenship, Women's Movements, Environment Laws.
19. Conflict and Peace Building – Dimensions of Conflict, Peacebuilding, Mediation, Diplomacy, Media

**B.A. NON-HONOURS GEOGRAPHY**

20. **Physical Geography**
    - Definition and Scope; Components of Earth System
    - Atmosphere: Heat Balance, Circulation, Cyclones, Monsoon, Koppen Classification
    - Lithosphere: Earth's Internal Structure, Plate Tectonics
    - Fluvial Cycle: Davis and Penck Models
    - Hydrosphere: Hydrological Cycle, Ocean Relief, Tides and Currents

21. **Human Geography**
    - Definition, Nature and Subfields; Cultural Regions, Race, Religion, Language
    - Population Growth, Demographic Transition, Distribution, Composition
    - Rural and Urban Settlement Patterns; Urbanization Trends

22. **General Cartography**
    - Types and Elements of Maps; Scale and Distance Measurement
    - Map Projections: Zenithal, Cylindrical, Conical, Bonne, Mercator
    - Data Representation: Symbols, Choropleth, Isopleth, Flow Maps
    - Interpretation of Thematic Maps

23. **Environmental Geography**
    - Concepts and Approaches, Ecosystem Structure and Function
    - Human-Environment Relationships in Various Regions
    - Environmental Issues: Air Pollution, Biodiversity Loss, Waste
    - Environmental Policies: Global and National (India), Sustainable Practices

24. **Regional Planning and Development**
    - Concept and Types of Regional Planning
    - Planning Regions, Agro-Ecological Zoning
    - Growth Pole Theory, Core-Periphery, Growth Foci
    - Special Area Plans, DVC, NITI Aayog Initiatives

25. **Remote Sensing and GPS**
    - Remote Sensing: Definition, Platforms, EMR Interaction
    - Aerial Photography and Satellite Sensors (Landsat, IRS)
    - Interpretation for Land Use, GPS Principles and Field Applications

26. **GIS Applications**
    - GIS Definition and Components, Raster vs. Vector Data

- Geo-referencing, Data Editing and Output
- Applications: Urban Sprawl, Forest Monitoring, Land Use Mapping

27. **Field Techniques**
    - Importance and Ethics of Field Work
    - Field Survey Methods: Observation, Interviews, Transects
    - Designing a Field Report: Objectives, Methods, Analysis
    - Individual Report Writing Based on Fieldwork

28. **Geography of India**
    - Physical Setting, Population Trends, Rural and Urban Settlement Systems
    - Resources: Livestock, Minerals, Energy
    - Agriculture: Rice, Wheat, Cotton; Industries; Transport Modes

29. **Economic Geography**
    - Primary, Secondary, Tertiary Sectors; Development Approaches
    - Von Thunen and Weber's Theories
    - Farming, Fishing, Mining, Manufacturing, Trade Patterns

30. **Disaster Management**
    - Hazards, Risk, Vulnerability, Disasters
    - Natural Disasters: Flood, Earthquake, Cyclone, Drought, Tsunami
    - Human-Induced Disasters: Causes and Responses
    - Mitigation, Preparedness, NDMA/NIDM, Community Management

31. **Geography of Tourism**
    - Tourism Scope and Inter-relationships; Types: Eco, Cultural, Medical, MICE
    - Trends in Regional and International Tourism
    - Economic, Environmental, Social Impacts; Tourism Policy and Case Studies

32. **Disaster Risk Reduction**
    - Concepts of Disaster Risk, Impact Mapping
    - Mitigation Strategies, NDMA/NIDM, Do’s and Don’ts During Disasters

33. **Sustainability and Development**
    - Definition and Components of Sustainability
    - MDGs, SDGs, National and Global Policies
    - Inclusive Development: Education, Health, Climate Policies
    - Governance, CDM, Rio+20, Financing for Sustainable Development

**B.A. NON-HONOURS HISTORY**

34. **History of Early and Medieval India (750–1206)**
    - Historical geography and source materials: texts, epigraphy, numismatics
    - Political structures: Rajputs, Rashtrakutas, Palas, Pratiharas, Cholas, Turkish invasions
    - Agrarian structure and feudal debates
    - Trade, urbanization, and merchant guilds
    - Religious and cultural developments: Tantrism, Sufism, vernacular literature, regional art

35. **Delhi Sultanate and Regional Polities (1206–1550)**
    - Source traditions: Persian chronicles, vernacular epics, inscriptions
    - Political structures under Khaljis, Tughluqs, Lodis; Mongol and Timurid invasions
    - Provincial kingdoms: Vijaynagar, Bahmani, Bengal

- Society, economy, and monetization; Iqta, trade
- Sufism and Bhakti movements; vernacular culture and literature

36. **Mughal India (1550–1750s)**
    - Sources and historiography: Persian chronicles, vernacular traditions, modern interpretations
    - Empire building from Babur to Aurangzeb: military, administration, Rajput diplomacy
    - Land rights, agriculture, revenue, trade and internal commerce
    - Art and architecture, literature, and religious pluralism (sulh-i-kul, Din-i Ilahi)
    - Decline and successor states: Marathas, Awadh, Bengal

37. **History of Modern India (1750–1950)**
    - Colonial expansion: Plassey to Dalhousie, policies and resistances
    - Colonial state structure: army, law, police, education
    - Deindustrialization, land revenue, drain of wealth
    - 1857 Revolt and peasant uprisings (Santhal, Indigo, Deccan, Pabna)
    - Freedom struggle: Gandhian and leftist trends, communalism, constitution making

38. **History of Modern Assam (1826–1947)**
    - British consolidation and administration; David Scott, Jenkins, Robertson
    - Early revolts: Gomdhar Konwar, Piyali Phukan, 1857 in Assam
    - Nationalist upsurge: Swadeshi, Non-Cooperation, Civil Disobedience, Quit India
    - Cultural developments, education, press, Assamese identity
    - Trade, plantations, industries and migration politics

39. **History of Europe (1453–1945)**
    - Renaissance and Reformation; Thirty Years War
    - Colonial expansion and commercial revolution
    - Scientific revolution, Enlightenment, Industrial revolution
    - French Revolution and Napoleonic era; Congress of Vienna
    - Unifications of Germany and Italy, Russian reforms, Imperialism
    - World Wars I and II, fascism, socialism, and post-war reorganization

40. **Historiography and Methods**
    - Nature and purpose of history; causation and objectivity
    - Greek, Roman, Chinese, Arab, Christian, and Renaissance historiography
    - Scientific, Marxist and Enlightenment approaches to history
    - Indian traditions: Rajatarangini, Mughal and regional chronicles
    - Modern Indian historiography: Colonial, Nationalist, Marxist, Subaltern

**B.A. NON-HONOURS ECONOMICS**

41. **Microeconomic Theory**
    - Basic economic problems: scarcity, choice, opportunity cost, production possibility frontier.
    - Demand and supply: laws, determinants, elasticity, consumer and producer surplus.
    - Consumer behaviour: utility approach, indifference curves, income and substitution effects.
    - Production and cost: production functions, law of variable proportions, isoquant and isocost.
    - Market structures: perfect competition, monopoly, monopolistic competition, oligopoly.
    - Factor pricing and income distribution: input demand, marginal productivity, labour markets.
    - Market failure and externalities: public goods, adverse selection, moral hazard, government interventions.

42. **Macroeconomic Theory**
    - Introduction to macroeconomics: macroeconomic issues, classical and Keynesian views.

- National income accounting: GDP, GNP, NDP, methods of measurement, circular flow.
- Determinants of GDP: consumption, investment, multiplier, fiscal and monetary tools.
- IS-LM model: goods and money market equilibrium, multipliers, aggregate demand and supply.
- Inflation and unemployment: demand-pull and cost-push inflation, Phillips Curve, Okun's Law.
- Open economy macroeconomics: international trade theories, balance of payments, exchange rates.

43. **Indian Economic Development and Policy**
    - Growth and development: sustainability, human development, inclusive growth, regional disparities.
    - Demography: population trends, composition, demographic dividend, urbanisation.
    - Employment: occupational structure, unemployment types, employment schemes.
    - Sectoral performance: agriculture (productivity, credit, pricing), industry (MSME, FDI), services.
    - Policy framework: fiscal and monetary policies, centre-state finance, planning and reforms.

44. **Monetary and Financial System**
    - Money: concepts, functions, supply determination, RBI and high-powered money.
    - Financial markets: call money, treasury bills, commercial bills, securities, primary & secondary markets.
    - Stock market operations: indices, methodologies, BSE, NSE.
    - Interest rates: theories, term structure, interest rates in India.
    - Banking system: commercial banks, credit creation, monetary policy and RBI functions.

45. **Public Finance**
    - Fiscal functions: allocation, distribution, stabilization, welfare economics.
    - Public goods: characteristics, free rider problem, Lindahl equilibrium, public expenditure.
    - Externalities: corrective measures, Coase theorem, regulations, pollution control.
    - Taxation: incidence, excess burden, specific vs lump sum taxes, efficiency and equity.
    - Indian public finance: budget analysis, deficits, fiscal federalism, state-local finances.

46. **Environmental and Development Economics**
    - Environment and economy: market failure, externalities, Pigouvian tax, Coase theorem.
    - Environmental policy tools: tradable permits, joint forest management, global treaties.
    - Valuation methods: contingent valuation, travel cost method.
    - Sustainable development: strong/weak sustainability, Pearce–Atkinson indicator.

47. **Economic History of India (1857–1947)**
    - Colonial background: inheritance laws, socio-economic backwardness, drain theory.
    - Macro trends: national income, population, occupational structure, urbanisation, poverty.
    - Agriculture: land systems, markets, productivity, labour, famines, partition impacts.
    - Industry and transport: de-industrialisation, capitalist enterprise, railways, roads, labour policies.
    - Imperial economy: foreign capital, trade, public debt, provincial finance, guided underdevelopment.

48. **Introductory Economics**
    - Exploring economics: economic systems, models, scarcity and choice, incentives.
    - Demand and supply: price controls, elasticity, market efficiency, taxation.
    - Consumer choice: indifference curves, labour-leisure, consumption-savings decisions.
    - Production: cost concepts, economies of scale, firm behaviour.

- Input markets: marginal productivity, labour markets, input demand.

49. **Introductory Macroeconomics**
    - Macro vs micro, GDP, GNP, national income components and deflators.
    - Income measurement: income, expenditure, product methods, circular flow.
    - Money and banking: quantity theory, Keynesian theory, credit, monetary policy.
    - Inflation and deflation: causes, consequences, measures, hyperinflation.
    - Income determination: Say's Law, Keynesian model, IS-LM model, multipliers.

**B.A. NON-HONOURS EDUCATION**

50. **Philosophical Foundations of Education**
    - Meaning, nature, and scope of education: formal, informal, non-formal
    - Aims and functions of education across different levels
    - Philosophy and education: aims, curriculum, methods, discipline
    - Indian schools of philosophy: Yoga, Vedanta, Buddhism and their educational impact
    - Western philosophies: Idealism, Naturalism, Pragmatism and their educational applications
    - Curriculum and co-curricular activities from philosophical perspectives

51. **Psychological Foundations of Education**
    - Educational Psychology: nature, scope, and significance
    - Schools of psychology: Behaviourism, Structuralism, Functionalism, etc.
    - Learning: types, theories (Thorndike, Pavlov, Skinner, Gestalt), motivation and memory
    - Intelligence: concepts, theories, emotional intelligence, creativity and giftedness
    - Personality and mental health: type and trait theories, instincts and adjustment

52. **Sociological Foundations of Education**
    - Educational Sociology: meaning, importance, theories (conflict, consensus)
    - Education and socialization: agencies, social mobility, modernization
    - Education and social change: culture, economy, development, human resource
    - Social groups in India: SC, ST, Women, Rural populations
    - Political ideologies and education: democracy, communism, secularism

53. **Emerging Trends in Indian Education**
    - Constitution and education: fundamental rights, directive principles, educational articles
    - Challenges at various levels: ECCE, elementary, secondary, higher, vocational, teacher education
    - Contemporary concerns: Environmental, Gender, Inclusive, Adult, Peace, Human Rights Education
    - ICT in education, curriculum issues, CCE, privatization and globalization
    - Role of international agencies: UNESCO, UNICEF, MDGs, EFA

54. **Great Educators and Educational Thought**
    - Ancient Indian thinkers: Shankaracharya, Yagyavalkya, Sankardeva
    - Modern Indian educators: Tagore, Vivekananda, Gandhi
    - Western philosophers: Plato, Rousseau, Dewey, Derrida, Sartre
    - Alternative education perspectives: Ivan Illich, Paulo Freire

55. **Measurement and Evaluation in Education**
    - Concepts of measurement and evaluation, types, formative/summative evaluation
    - Psychological testing: types, tools and characteristics
    - Achievement, intelligence, aptitude, and personality tests
    - Educational statistics: central tendency, variability, correlation, normal curve

- Graphical data presentation: histograms, polygons, ogives

56. **Education in Pre-Independent India**
    - Ancient and medieval education systems: Vedic, Buddhist, Islamic
    - Missionary and East India Company educational initiatives
    - Key developments: Wood's Despatch, Hunter Commission, Wardha Scheme, Sargent Report

57. **Education in World Perspective**
    - Comparative education: nature, factors, methods
    - Education systems in USA, UK, Japan and India (curriculum, examination, administration)
    - Technical/vocational, teacher and distance education in global context

58. **Guidance and Counselling**
    - Concept, types and principles of guidance and counselling
    - Tools and techniques: tests, interviews, observations, sociometry
    - Educational and vocational guidance: role of teachers, headmasters, parents
    - Counselling for adjustment, special groups, organization of services

59. **Value and Peace Education**
    - Concepts and types of values, fostering values
    - Dimensions of value education and policy perspectives
    - Pedagogical approaches to value education
    - Peace education: objectives, pedagogy, global perspectives

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**Syllabus for Assamese (Honours) with Political Science or Geography or History or Economics or Education (Post Code: GTAS12026)**

1. **অসমীয়া সাহিত্যৰ ইতিহাস** : আদিকাল, মধ্যযুগ, সংস্কাৰ যুগৰ সাহিত্যিক বৈশিষ্ট্য আৰু প্ৰধান সাহিত্যিকসকল ।
2. **অসমীয়া সাহিত্যৰ ইতিহাস** : আধুনিক যুগৰ সাহিত্য – ৰেনেছাঁৰ প্ৰভাৱ, জাতীয়তা বোধ, প্ৰগতিশীল সাহিত্য।
3. **ভাষাবিজ্ঞানৰ পৰিচয়**: ভাষাৰ স্বৰূপ, ধ্বনিতত্ব, শব্দতত্ব, বাক্যতত্ব, অৰ্থবিজ্ঞান।
4. **কাব্যতত্ত্ব (ভাৰতীয় আৰু পাশ্চাত্য):** ৰসতত্ত্ব, ধ্বনিতত্ত্ব, অলংকাৰ, পাশ্চাত্য সমালোচনাতত্ত্ব, প্লেটো, এৰিষ্ট'টল, লংগিনাছ।
5. **আধুনিক অসমীয়া কবিতা**: উনবিংশ শতিকাৰ পৰা সমকালীন কবিতা, হেমচন্দ্ৰ, জীৱনানন্দ, নীলমণি ফুকন, নৱকান্ত বৰুৱা।
6. **অসমীয়া নাটক**: সংস্কাৰ যুগৰ নাট্য, আধুনিক নাট্যচিন্তা, ভৱানী পাঠক, মাধৱদেৱ, দীনবন্ধু মিত্ৰৰ নাট্যচিন্তা।
7. **অসমীয়া গদ্য আৰু গল্প সাহিত্য:** হেমচন্দ্ৰ, লীলাৱতী, চন্দ্ৰকান্ত, লক্ষ্মীনাথ বেজবৰুৱা।
8. **অসমীয়া উপন্যাস:** সমকালীন উপন্যাস – ইন্দিৰা গোস্বামী, অৰ্ণৱ পাটোৱাৰী, ৰুণুমী গগৈ।
9. **অসমীয়া সমালোচনাৰ ইতিহাস:** সাহিত্য সমালোচনাৰ ধাৰা, সমসাময়িক সাহিত্যিক সমালোচনাৰ বৈশিষ্ট্য।
10. **সম্পাদনা আৰু প্ৰকাশন:** গ্ৰন্থ সম্পাদনা, প্ৰুফ ৰিডিং, ভাষা শুদ্ধি, সংবাদ সম্পাদনা।
11. **অনুবাদবিদ্যা:** অনুবাদৰ তত্ত্ব, শব্দান্তৰ, ৰূপান্তৰ, সাংস্কৃতিক স্থানান্তৰ ।
12. **তুলনামূলক সাহিত্য:** অসমীয়া আৰু অন্যান্য ভাৰতীয় ভাষাৰ সাহিত্যৰ তুলনা।
13. **নাট্যপ্ৰয়োগ** - নাটক ৰচনা আৰু মঞ্চ ব্যৱস্থা।
14. **চিত্ৰনাট্য আৰু মাধ্যম লিখনী:** আখ্যান ৰচনা, দৃশ্যকল্প বিন্যাস।
15. **যোগাযোগমূলক অসমীয়া** – শব্দ-গঠন, বাক্য-গঠন, ব্যাকৰণ, আনুষ্ঠানিক চিঠি আৰু প্ৰতিবেদন লিখনী।
16. **অসমৰ সংস্কৃতি আৰু সাংস্কৃতিক পৰ্যটন:** লোকসাহিত্য, পৰম্পৰা, উৎসৱ, পৰ্যটন শিল্প।
17. **অসমীয়া সাহিত্য শিক্ষাদান** – পাঠ্যবস্তু নিৰ্বাচন, অধ্যয়ন পদ্ধতি, শিক্ষাদান কৌশল ।
18. **অসমীয়া লোকসাহিত্য** – কাহিনী, লোকগীত, লোকনাট্য, কিম্বদন্তি, আচাৰ-ব্যৱহাৰ ।

**B.A. NON-HONOURS POLITICAL SCIENCE**

19. **Introduction to Political Theory – Concepts: Democracy, Liberty, Equality, Justice, Rights, Citizenship, Civil Society, Debates.**
20. Indian Government and Politics – Constitution, Parliament, PM, Judiciary, Caste, Class, Religion, Movements.
21. Comparative Government and Politics – UK, USA, Canada, China, Electoral Systems, Party Systems, Globalisation.
22. Introduction to International Relations – Realism, Neo-liberalism, Cold War, India's Foreign Policy, Global Powers.
23. Themes in Comparative Political Theory – Aristotle, Locke, Marx, Gandhi, Ambedkar, Lohia, Ramabai.
24. Administration and Public Policy – Public Administration, Theories, Policy Formulation, New Public Management.
25. Reading Gandhi – Hind Swaraj, Women’s Question, Anti-Racism Movements.
26. Democratic Awareness with Legal Literacy – Constitution, Rights, Gender, Criminal Law, Lok Adalats.
27. Democracy and Governance – Parliament, Judiciary, Development Models, Civil Society.

28. Understanding Globalization – UN, WTO, G-77, Global Warming, Terrorism.
29. Human Rights, Gender and Environment – Inequality, Citizenship, Women's Movements, Environment Laws.
30. Conflict and Peace Building – Dimensions of Conflict, Peacebuilding, Mediation, Diplomacy, Media

## B.A. NON-HONOURS GEOGRAPHY

### 31. Physical Geography

- Definition and Scope; Components of Earth System
- Atmosphere: Heat Balance, Circulation, Cyclones, Monsoon, Koppen Classification
- Lithosphere: Earth's Internal Structure, Plate Tectonics
- Fluvial Cycle: Davis and Penck Models
- Hydrosphere: Hydrological Cycle, Ocean Relief, Tides and Currents

**Human Geography**

- Definition, Nature and Subfields; Cultural Regions, Race, Religion, Language
- Population Growth, Demographic Transition, Distribution, Composition
- Rural and Urban Settlement Patterns; Urbanization Trends

**General Cartography**

- Types and Elements of Maps; Scale and Distance Measurement
- Map Projections: Zenithal, Cylindrical, Conical, Bonne, Mercator
- Data Representation: Symbols, Choropleth, Isopleth, Flow Maps
- Interpretation of Thematic Maps

**Environmental Geography**

- Concepts and Approaches, Ecosystem Structure and Function
- Human-Environment Relationships in Various Regions
- Environmental Issues: Air Pollution, Biodiversity Loss, Waste
- Environmental Policies: Global and National (India), Sustainable Practices

**Regional Planning and Development**

- Concept and Types of Regional Planning
- Planning Regions, Agro-Ecological Zoning
- Growth Pole Theory, Core-Periphery, Growth Foci
- Special Area Plans, DVC, NITI Aayog Initiatives

**Remote Sensing and GPS**

- Remote Sensing: Definition, Platforms, EMR Interaction
- Aerial Photography and Satellite Sensors (Landsat, IRS)
- Interpretation for Land Use, GPS Principles and Field Applications

**GIS Applications**

- GIS Definition and Components, Raster vs. Vector Data
- Geo-referencing, Data Editing and Output
- Applications: Urban Sprawl, Forest Monitoring, Land Use Mapping

**Field Techniques**

- Importance and Ethics of Field Work
- Field Survey Methods: Observation, Interviews, Transects
- Designing a Field Report: Objectives, Methods, Analysis
- Individual Report Writing Based on Fieldwork

**Geography of India**

- Physical Setting, Population Trends, Rural and Urban Settlement Systems
- Resources: Livestock, Minerals, Energy
- Agriculture: Rice, Wheat, Cotton; Industries; Transport Modes

**Economic Geography**

- Primary, Secondary, Tertiary Sectors; Development Approaches
- Von Thunen and Weber's Theories
- Farming, Fishing, Mining, Manufacturing, Trade Patterns

**Disaster Management**

- Hazards, Risk, Vulnerability, Disasters
- Natural Disasters: Flood, Earthquake, Cyclone, Drought, Tsunami
- Human-Induced Disasters: Causes and Responses
- Mitigation, Preparedness, NDMA/NIDM, Community Management

**32. Geography of Tourism**

- Tourism Scope and Inter-relationships; Types: Eco, Cultural, Medical, MICE
- Trends in Regional and International Tourism
- Economic, Environmental, Social Impacts; Tourism Policy and Case Studies

**33. Disaster Risk Reduction**

- Concepts of Disaster Risk, Impact Mapping
- Mitigation Strategies, NDMA/NIDM, Do’s and Don’ts During Disasters

**34. Sustainability and Development**

- Definition and Components of Sustainability
- MDGs, SDGs, National and Global Policies
- Inclusive Development: Education, Health, Climate Policies
- Governance, CDM, Rio+20, Financing for Sustainable Development

**B.A. NON-HONOURS HISTORY**

**35. History of Early and Medieval India (750–1206)**

- Historical geography and source materials: texts, epigraphy, numismatics
- Political structures: Rajputs, Rashtrakutas, Palas, Pratiharas, Cholas, Turkish invasions
- Agrarian structure and feudal debates
- Trade, urbanization, and merchant guilds
- Religious and cultural developments: Tantrism, Sufism, vernacular literature, regional art

**36. Delhi Sultanate and Regional Polities (1206–1550)**

- Source traditions: Persian chronicles, vernacular epics, inscriptions
- Political structures under Khaljis, Tughluqs, Lodis; Mongol and Timurid invasions
- Provincial kingdoms: Vijaynagar, Bahmani, Bengal
- Society, economy, and monetization; Iqta, trade
- Sufism and Bhakti movements; vernacular culture and literature

**37. Mughal India (1550–1750s)**

- Sources and historiography: Persian chronicles, vernacular traditions, modern interpretations
- Empire building from Babur to Aurangzeb: military, administration, Rajput diplomacy
- Land rights, agriculture, revenue, trade and internal commerce
- Art and architecture, literature, and religious pluralism (sulh-i-kul, Din-i Ilahi)

- Decline and successor states: Marathas, Awadh, Bengal

**38. History of Modern India (1750–1950)**

- Colonial expansion: Plassey to Dalhousie, policies and resistances
- Colonial state structure: army, law, police, education
- Deindustrialization, land revenue, drain of wealth
- 1857 Revolt and peasant uprisings (Santhal, Indigo, Deccan, Pabna)
- Freedom struggle: Gandhian and leftist trends, communalism, constitution making

**39. History of Modern Assam (1826–1947)**

- British consolidation and administration; David Scott, Jenkins, Robertson
- Early revolts: Gomdhar Konwar, Piyali Phukan, 1857 in Assam
- Nationalist upsurge: Swadeshi, Non-Cooperation, Civil Disobedience, Quit India
- Cultural developments, education, press, Assamese identity
- Trade, plantations, industries and migration politics

**40. History of Europe (1453–1945)**

- Renaissance and Reformation; Thirty Years War
- Colonial expansion and commercial revolution
- Scientific revolution, Enlightenment, Industrial revolution
- French Revolution and Napoleonic era; Congress of Vienna
- Unifications of Germany and Italy, Russian reforms, Imperialism
- World Wars I and II, fascism, socialism, and post-war reorganization

**41. Historiography and Methods**

- Nature and purpose of history; causation and objectivity
- Greek, Roman, Chinese, Arab, Christian, and Renaissance historiography
- Scientific, Marxist and Enlightenment approaches to history
- Indian traditions: Rajatarangini, Mughal and regional chronicles
- Modern Indian historiography: Colonial, Nationalist, Marxist, Subaltern

## B.A. NON-HONOURS ECONOMICS

**42. Microeconomic Theory**

- Basic economic problems: scarcity, choice, opportunity cost, production possibility frontier.
- Demand and supply: laws, determinants, elasticity, consumer and producer surplus.
- Consumer behaviour: utility approach, indifference curves, income and substitution effects.
- Production and cost: production functions, law of variable proportions, isoquant and isocost.
- Market structures: perfect competition, monopoly, monopolistic competition, oligopoly.
- Factor pricing and income distribution: input demand, marginal productivity, labour markets.
- Market failure and externalities: public goods, adverse selection, moral hazard, government interventions.

**43. Macroeconomic Theory**

- Introduction to macroeconomics: macroeconomic issues, classical and Keynesian views.
- National income accounting: GDP, GNP, NDP, methods of measurement, circular flow.
- Determinants of GDP: consumption, investment, multiplier, fiscal and monetary tools.
- IS-LM model: goods and money market equilibrium, multipliers, aggregate demand and supply.
- Inflation and unemployment: demand-pull and cost-push inflation, Phillips Curve, Okun’s Law.
- Open economy macroeconomics: international trade theories, balance of payments, exchange rates.

**44. Indian Economic Development and Policy**

- Growth and development: sustainability, human development, inclusive growth, regional disparities.
- Demography: population trends, composition, demographic dividend, urbanisation.
- Employment: occupational structure, unemployment types, employment schemes.
- Sectoral performance: agriculture (productivity, credit, pricing), industry (MSME, FDI), services.
- Policy framework: fiscal and monetary policies, centre-state finance, planning and reforms.

**45. Monetary and Financial System**

- Money: concepts, functions, supply determination, RBI and high-powered money.
- Financial markets: call money, treasury bills, commercial bills, securities, primary & secondary markets.
- Stock market operations: indices, methodologies, BSE, NSE.
- Interest rates: theories, term structure, interest rates in India.
- Banking system: commercial banks, credit creation, monetary policy and RBI functions.

**46. Public Finance**

- Fiscal functions: allocation, distribution, stabilization, welfare economics.
- Public goods: characteristics, free rider problem, Lindahl equilibrium, public expenditure.
- Externalities: corrective measures, Coase theorem, regulations, pollution control.
- Taxation: incidence, excess burden, specific vs lump sum taxes, efficiency and equity.
- Indian public finance: budget analysis, deficits, fiscal federalism, state-local finances.

**47. Environmental and Development Economics**

- Environment and economy: market failure, externalities, Pigouvian tax, Coase theorem.
- Environmental policy tools: tradable permits, joint forest management, global treaties.
- Valuation methods: contingent valuation, travel cost method.
- Sustainable development: strong/weak sustainability, Pearce–Atkinson indicator.

**48. Economic History of India (1857–1947)**

- Colonial background: inheritance laws, socio-economic backwardness, drain theory.
- Macro trends: national income, population, occupational structure, urbanisation, poverty.
- Agriculture: land systems, markets, productivity, labour, famines, partition impacts.
- Industry and transport: de-industrialisation, capitalist enterprise, railways, roads, labour policies.
- Imperial economy: foreign capital, trade, public debt, provincial finance, guided underdevelopment.

**49. Introductory Economics**

- Exploring economics: economic systems, models, scarcity and choice, incentives.
- Demand and supply: price controls, elasticity, market efficiency, taxation.
- Consumer choice: indifference curves, labour-leisure, consumption-savings decisions.
- Production: cost concepts, economies of scale, firm behaviour.
- Input markets: marginal productivity, labour markets, input demand.

**50. Introductory Macroeconomics**

- Macro vs micro, GDP, GNP, national income components and deflators.
- Income measurement: income, expenditure, product methods, circular flow.
- Money and banking: quantity theory, Keynesian theory, credit, monetary policy.
- Inflation and deflation: causes, consequences, measures, hyperinflation.
- Income determination: Say’s Law, Keynesian model, IS-LM model, multipliers.

## B.A. NON-HONOURS EDUCATION

### 51. Philosophical Foundations of Education

- Meaning, nature, and scope of education: formal, informal, non-formal
- Aims and functions of education across different levels
- Philosophy and education: aims, curriculum, methods, discipline
- Indian schools of philosophy: Yoga, Vedanta, Buddhism and their educational impact
- Western philosophies: Idealism, Naturalism, Pragmatism and their educational applications
- Curriculum and co-curricular activities from philosophical perspectives

### 52. Psychological Foundations of Education

- Educational Psychology: nature, scope, and significance
- Schools of psychology: Behaviourism, Structuralism, Functionalism, etc.
- Learning: types, theories (Thorndike, Pavlov, Skinner, Gestalt), motivation and memory
- Intelligence: concepts, theories, emotional intelligence, creativity and giftedness
- Personality and mental health: type and trait theories, instincts and adjustment

### 53. Sociological Foundations of Education

- Educational Sociology: meaning, importance, theories (conflict, consensus)
- Education and socialization: agencies, social mobility, modernization
- Education and social change: culture, economy, development, human resource
- Social groups in India: SC, ST, Women, Rural populations
- Political ideologies and education: democracy, communism, secularism

### 54. Emerging Trends in Indian Education

- Constitution and education: fundamental rights, directive principles, educational articles
- Challenges at various levels: ECCE, elementary, secondary, higher, vocational, teacher education
- Contemporary concerns: Environmental, Gender, Inclusive, Adult, Peace, Human Rights Education
- ICT in education, curriculum issues, CCE, privatization and globalization
- Role of international agencies: UNESCO, UNICEF, MDGs, EFA

### 55. Great Educators and Educational Thought

- Ancient Indian thinkers: Shankaracharya, Yagyavalkya, Sankardeva
- Modern Indian educators: Tagore, Vivekananda, Gandhi
- Western philosophers: Plato, Rousseau, Dewey, Derrida, Sartre
- Alternative education perspectives: Ivan Illich, Paulo Freire

### 56. Measurement and Evaluation in Education

- Concepts of measurement and evaluation, types, formative/summative evaluation
- Psychological testing: types, tools and characteristics
- Achievement, intelligence, aptitude, and personality tests
- Educational statistics: central tendency, variability, correlation, normal curve
- Graphical data presentation: histograms, polygons, ogives

### 57. Education in Pre-Independent India

- Ancient and medieval education systems: Vedic, Buddhist, Islamic
- Missionary and East India Company educational initiatives
- Key developments: Wood’s Despatch, Hunter Commission, Wardha Scheme, Sargent Report

### 58. Education in World Perspective

- Comparative education: nature, factors, methods

- Education systems in USA, UK, Japan and India (curriculum, examination, administration)
- Technical/vocational, teacher and distance education in global context

**59. Guidance and Counselling**

- Concept, types and principles of guidance and counselling
- Tools and techniques: tests, interviews, observations, sociometry
- Educational and vocational guidance: role of teachers, headmasters, parents
- Counselling for adjustment, special groups, organization of services

**60. Value and Peace Education**

- Concepts and types of values, fostering values
- Dimensions of value education and policy perspectives
- Pedagogical approaches to value education
- Peace education: objectives, pedagogy, global perspectives

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# SYLLABUS FOR B.SC. (PHYSICS HONOURS) WITH MATHEMATICS AND CHEMISTRY (POST CODE: GTPH12026)

## B.SC. (HONOURS) PHYSICS

### 1. Mathematical Physics

- Vector Algebra & Calculus: Gradient, Divergence, Curl, Vector identities
- Vector Integration: Gauss's, Green's, and Stokes' Theorems
- Curvilinear Coordinates: Gradient, Divergence, Curl in spherical and cylindrical coordinates
- Probability Theory: Binomial, Gaussian, Poisson distributions
- Dirac Delta Function: Properties, representations

### 2. Electricity and Magnetism

- Vector Analysis and Electrostatics: Gauss's law, potential, electric field
- Capacitance, Conductors, Dielectrics
- Magnetostatics and Magnetic Properties: Biot-Savart law, Ampere's law, magnetic susceptibility
- Electromagnetic Induction: Faraday's law, inductance, energy storage
- Maxwell's Equations and EM Waves: Displacement current, Poynting vector, wave propagation

### 3. Quantum Mechanics and Applications

- Time-dependent and Time-independent Schrödinger Equation
- Bound States and Harmonic Oscillator
- Hydrogen Atom: Radial wave functions, orbital angular momentum
- Atoms in Fields: Zeeman, Stark effects, Spin and angular momentum
- Multi-electron Atoms: Pauli Principle, Term symbols, Spectra

### 4. Solid State Physics

- Crystal Structure and X-ray Diffraction: Unit cell, Brillouin zones, Bragg's law
- Lattice Vibrations and Phonons: Monoatomic and Diatomic Chains, Specific Heat Theories
- Magnetism: Paramagnetism, Ferromagnetism, B-H curve, Hysteresis
- Dielectrics and Ferroelectrics: Polarization, Dispersion, Ferroelectric domains
- Band Theory and Superconductivity: Kronig-Penney model, Hall effect, BCS theory

### 5. Statistical Mechanics

- Classical Theory of Radiation: Blackbody laws, Wien's displacement
- Quantum Statistics: Bose-Einstein, Fermi-Dirac distributions
- Thermodynamic Functions: Entropy, partition function, energy fluctuation
- Applications: Photon and electron gas, white dwarf, Planck law derivations

## B.SC. (NON-HONOURS) CHEMISTRY

6. Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons
7. Chemical Energetics, Equilibria and Functional Group Organic Chemistry
8. Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry
9. Transition Metals, Coordination Chemistry, States of Matter and Chemical Kinetics

## B.SC. (NON-HONOURS) MATHEMATICS

### 10. Differential Calculus

- Limits and Continuity, Types of Discontinuity, Partial Differentiation, Euler's Theorem

- Tangents, Normals, Curvature, Asymptotes, Curve Tracing in Cartesian, Parametric and Polar Coordinates
- Taylor's and Maclaurin's Series, Rolle's and Mean Value Theorems, Maxima and Minima
- Exact Equations, Higher Order Equations, Linear Differential Equations, Wronskian
- Linear Equations with Constant Coefficients, Cauchy-Euler Equations, Variation of Parameters
- Partial Differential Equations – Lagrange's and Charpit's Methods, Classification of PDEs

**11. Real Analysis**

- Real Line and Completeness, Sequences and Series, Convergence Tests
- Cauchy Criterion, Monotone Sequences, Power Series, Uniform Convergence
- Pointwise and Uniform Convergence of Functions, Integrability, Differentiability

**12. Algebra**

- Groups, Subgroups, Cyclic Groups, Permutation Groups, Quotient Groups
- Rings and Fields – Definitions, Subrings, Ideals, Fields of Rational and Real Numbers

**13. Matrices**

- Vector Spaces, Basis, Rank of Matrix
- Matrix Transformations and Geometry, Eigenvalues and Eigenvectors
- Diagonalization, Matrix Inversion, Solutions of Systems of Linear Equations

**14. Logic and Sets**

- Propositional Logic, Truth Tables, Logical Connectives, Quantifiers
- Set Theory – Operations, Power Set, Relations and Equivalence Relations

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**SYLLABUS FOR GEOGRAPHY (HONOURS) WITH HISTORY OR ECONOMICS OR POLITICAL SCIENCE OR EDUCATION ( POST CODE: GTGE12026)**

1. Introduction to Geomorphology and Oceanography: a . Geomorphology: Meaning, Definition, Nature and Scope. b. Fundamental Geomorphic Concepts. c. Oceanography: Meaning Definition, Nature and Scope d. Ocean Bottom Relief Features
2. Geomorphic Processes (Endogenetic and Exogenetic) : a. Earth: Interior Structure and Isostasy. b. Earth Movements: Folds and Faults, Plate Tectonics, Earthquakes and Volcanoes. c. Exogenetic Processes-Weathering, Mass Wasting, d. Cycle of Erosion (Davis and Penck).
3. Salinity, Waves, Tides and Currents: a. Ocean Salinity and its distribution b. Ocean Temperature and their distribution c. Tides – Causes, Types and Effects d. Ocean currents –Formation and Effects
4. Introduction to Human Geography: a. Human Geography: Definition, Nature and Scope and contemporary relevance. b. Concepts of Environmental Determinism, Possibilism, Neo-Determinism.
5. Population: a. Factors affecting Growth and Distribution b. Composition (Age-Sex). c. Theories of Population- Demographic Transition Theory.
6. Disasters: a) Disasters: Definition and Concepts: Hazards, Disasters; Risk and Vulnerability; Classification b) Manmade disasters: Causes, Impact and Distribution
7. Disasters in India: a) Disasters in India: Flood, Landslide, Drought, Earthquake and Tsunami, Cyclone: Causes, Impact and Distribution
8. Atmospheric Temperature and Insolation: a. Atmosphere; Definition, Composition and structure b. Temperature; factors, Distribution c. Insolation, Heat budget, temperature inversion
9. Atmospheric pressure and winds: a. Pressure belts, Planetary Winds, Jet Streams, Monsoon. b. Concept of Airmass and Fronts, Cyclones and Anticyclones, Local winds.
10. Atmospheric Moisture, Weather and Climate: a. Evaporation, Humidity, Condensation, Fog and Clouds, Precipitation and its types b. Concept, Elements and factors of weather and climate, c. Climatic classification: Koeppen and Thornthwaite.
11. Introduction to Economic Geography: a. Meaning, Nature and Scope of Economic Geography, b. Approaches to the study: Systematic and Spatial approaches, c. Fundamental Concepts in Economic Geography
12. Introduction to Resources: a. Resource; Concept and Resource creating factors. b. Classification and Types of resources. c. Functional Theory of Resources
13. Economic Activities: a. Effect of Natural Environment on Economic Activities, b. Classification of economic activities: Primary, Secondary, Tertiary and Quaternary activities. c. International Trade
14. Environmental Geography: a. Concept, nature and scope of environmental geography, b. Ecology: Meaning, Nature, Types, Principles of ecology
15. Human Geography: a. Definition, Nature, Major Subfields, Contemporary Relevance b. Schools: Determinism, Possibilism and Neo-Determinism; c. Human development index: Developed, developing and Underdeveloped countries, problems and prospects
16. Social Geography: a. Definition, Nature and Scope of Social Geography b. Concept and types of space in Social Geography c. Society and environment d. Social problems in India: Education, Health, Gender, Housing and Crime.
17. Cultural Geography: a. Definition, nature and scope of Cultural Geography b. Cultural Regions of the World c. Cultural diffusion: meaning, factors affecting cultural diffusion
18. Introduction to Settlement Geography: a. Definition, nature and scope of settlement Geography b. Settlement: Definition and Types c. Factors affecting settlement distribution
19. Rural Settlement: a. Origin and growth of rural settlement b. Types and Patterns of Rural Settlement c. Morphology of rural settlement and rural settlement problems in India
20. Urban Settlement: a. Origin and growth of Urban settlement b. Basis of Classification and Hierarchy of Urban Settlement c. Morphology of urban settlement and problems of urban settlement in India
21. Introduction to Cartography: a. Meaning and its importance in Geography. b. Co-Ordinate System of Earth; Latitude Longitude and their importance; International time zone c. Maps: Concept and types

22. Human Geography: a. Human Geography: Definition, Nature, Scope & Contemporary Relevance; b. Approaches to the study of Human Geography; c. Human adaptation to various geographical conditions (Cold regions, hot regions, flood plains); d. Human groups (Races): Classification & their spatial distribution; e. Concept of Human Development
23. Population Geography: a. Definition, Nature and Scope b. Factors affecting distribution & density of population; Spatial distribution of Population; c. Population Composition-Literacy, Agesex, Religion, Rural-Urban, Occupational; d. Population Dynamics: Measures of Fertility, Mortality & Migration-measures & determinants; e. Demographic Transition theory; f. Contemporary Issues-Ageing of population, declining sex ratio, HIV/AIDS
24. Settlement Geography: a. Settlement: Concept & Classification. b. Rural Settlement: evolution, site and situational factors, patterns and types. c. Urban settlement: growth, functional classification of towns; d. Hierarchy of settlement, Primate City & Urban Fringe, Christaller's Central Place Theory
25. Conceptual Basis of Political Geography: a. Concept, Nature, Scope and approaches to Political Geography. b. State: Concept, elements; Geographical attributes of state: size, shape, location. c. Nation: Concept, nation building factors, nation state d. Frontier: Concept and types; Boundary: Concept, functions, types, classification
26. Oceanography: a. Oceanography: Meaning and significance. b. Configuration of ocean floor-continental shelf, continental slope, deep sea plain; Bottom configurations of the Atlantic, Pacific and Indian oceans. c. Salinity and temperature of ocean water. d. Ocean currents of the Atlantic
27. Introduction to Region and Regional Geography: a. Meaning and scope of Regional Geography-Concept of Regions, Realms, United Nation's geo-scheme. b. Bases of classifying geographic regions of the world- Formal & Functional.
28. Physiography and climate of the continents Physiography and climate of :– a. Asia and Europe b. North America and South America c. Africa and Oceania.
29. Resource base and industries: a. Mineral resource base (Coal, Petroleum and Natural Gas) of the world. b. Industrial development (Iron and Steel, Textile and Engineering) of the world.
30. World population and regional studies: a. Distribution of population of the World; issues of Population growth in Developed and Developing countries. b.Regional studies of Middle East, South East Asia and the Mediterranean region with special reference to their resource base.
31. Introduction to Cartography: a. Meaning and its importance in Geography; Nature and Development of Cartography. b. Maps: Concept, types, content, methods of representation of point, line and area. c. Thematic mapping- concept and types
32. Introduction to Economic Geography: a. Meaning, nature and scope of Economic Geography. b. Resource: Concept, nature and types. c. Fundamental concepts and recent trends of Economic Geography.
33. Economic Activities: a. Primary: Subsistence, Commercial and Plantation agriculture, Forestry, Fishing and Mining. b. Secondary: Iron and steel and cotton textile. c. Tertiary, quaternary and quinary.
34. Mineral resources and Industry: a. Distributional pattern and production of major mineral resources – coal, petroleum and iron ore. b. Industry: Factors of location; types of industries; industrial location theory of Losch and Weber. c. Major industrial regions of the world. d. Special Economic Zones;
35. Settlement Geography: a. Settlement geography: Meaning and scope. b. Types and patterns of settlement c. Rural settlement: Evolution, siting factors, types and morphology. d. Urban settlement: Evolution and morphology; functional classification of towns. e. Hierarchy of settlements
36. North East India: Physical and socio-cultural background: a. Physical: physiographic divisions, soil and vegetation, climate and drainage system. b. Socio-cultural background of North-East India-language and religion, cultural diversity.
37. North East India: Resource base and population: a. Resource: agriculture, forest, mineral and power resources of North East India. b. Industries of North East India; problems and prospects. c. Population: growth, distribution and density.

38. Assam: Physical and economic background: a. Physiographic divisions, climate, drainage, soil and natural vegetation. b. Resource: agriculture, forest, mineral and power. c. Population: growth, distribution and density. d. Industries of Assam
39. Introduction to Environmental Geography: a) Environmental Geography – Concept , Scope and significance b) Human Environment Relationship – Historical Progression, Adaptation in tropical, temperate and polar Biomes
40. Environmental problems and Programmes: a) Major Environmental Problems – Pollution, Deforestation, Desertification, Global Warming and Bio- Depletion. b) Environmental Programmes and Policies- Global, National and Local level.
41. Sustainable Development: a) Sustainable Development: Concept and Components. b) Significance of Sustainable Regional Development c) Sustainable Development Policies and Programmes – The proposal for SDGs at Rio +20; Principles of Good Governance; National Environmental Policy, CDM.
42. Flood Geomorphology: a) Flood as a geomorphic agent, flood frequency analysis, formation of floodplains. b) Analysis of paleo-flood & its relationship with paleo-climate
43. Soil Geography: Introduction a. Nature, Scope and Significance of Soil Geography. b. Soil forming factors: parent material, organic, climatic, topographic, Spatio-temporal dimensions. c. Processes of soil formation and soil development: Physical, Biotic and Chemical. Soil profile.

**B.A. Non-Honours History**

44. **History of Early and Medieval India (750–1206)**
    - Historical geography and source materials: texts, epigraphy, numismatics
    - Political structures: Rajputs, Rashtrakutas, Palas, Pratiharas, Cholas, Turkish invasions
    - Agrarian structure and feudal debates
    - Trade, urbanization, and merchant guilds
    - Religious and cultural developments: Tantrism, Sufism, vernacular literature, regional art

45. **Delhi Sultanate and Regional Polities (1206–1550)**
    - Source traditions: Persian chronicles, vernacular epics, inscriptions
    - Political structures under Khaljis, Tughluqs, Lodis; Mongol and Timurid invasions
    - Provincial kingdoms: Vijaynagar, Bahmani, Bengal
    - Society, economy, and monetization; Iqta, trade
    - Sufism and Bhakti movements; vernacular culture and literature

46. **Mughal India (1550–1750s)**
    - Sources and historiography: Persian chronicles, vernacular traditions, modern interpretations
    - Empire building from Babur to Aurangzeb: military, administration, Rajput diplomacy
    - Land rights, agriculture, revenue, trade and internal commerce
    - Art and architecture, literature, and religious pluralism (sulh-i-kul, Din-i Ilahi)
    - Decline and successor states: Marathas, Awadh, Bengal

47. **History of Modern India (1750–1950)**
    - Colonial expansion: Plassey to Dalhousie, policies and resistances
    - Colonial state structure: army, law, police, education
    - Deindustrialization, land revenue, drain of wealth
    - 1857 Revolt and peasant uprisings (Santhal, Indigo, Deccan, Pabna)
    - Freedom struggle: Gandhian and leftist trends, communalism, constitution making

48. **History of Modern Assam (1826–1947)**
    - British consolidation and administration; David Scott, Jenkins, Robertson
    - Early revolts: Gomdhar Konwar, Piyali Phukan, 1857 in Assam
    - Nationalist upsurge: Swadeshi, Non-Cooperation, Civil Disobedience, Quit India

- Cultural developments, education, press, Assamese identity
- Trade, plantations, industries and migration politics

49. **History of Europe (1453–1945)**
    - Renaissance and Reformation; Thirty Years War
    - Colonial expansion and commercial revolution
    - Scientific revolution, Enlightenment, Industrial revolution
    - French Revolution and Napoleonic era; Congress of Vienna
    - Unifications of Germany and Italy, Russian reforms, Imperialism
    - World Wars I and II, fascism, socialism, and post-war reorganization

50. **Historiography and Methods**
    - Nature and purpose of history; causation and objectivity
    - Greek, Roman, Chinese, Arab, Christian, and Renaissance historiography
    - Scientific, Marxist and Enlightenment approaches to history
    - Indian traditions: Rajatarangini, Mughal and regional chronicles
    - Modern Indian historiography: Colonial, Nationalist, Marxist, Subaltern

**B.A. Non-Honours Economics**

51. **Microeconomic Theory**
    - Basic economic problems: scarcity, choice, opportunity cost, production possibility frontier.
    - Demand and supply: laws, determinants, elasticity, consumer and producer surplus.
    - Consumer behaviour: utility approach, indifference curves, income and substitution effects.
    - Production and cost: production functions, law of variable proportions, isoquant and isocost.
    - Market structures: perfect competition, monopoly, monopolistic competition, oligopoly.
    - Factor pricing and income distribution: input demand, marginal productivity, labour markets.
    - Market failure and externalities: public goods, adverse selection, moral hazard, government interventions.

52. **Macroeconomic Theory**
    - Introduction to macroeconomics: macroeconomic issues, classical and Keynesian views.
    - National income accounting: GDP, GNP, NDP, methods of measurement, circular flow.
    - Determinants of GDP: consumption, investment, multiplier, fiscal and monetary tools.
    - IS-LM model: goods and money market equilibrium, multipliers, aggregate demand and supply.
    - Inflation and unemployment: demand-pull and cost-push inflation, Phillips Curve, Okun's Law.
    - Open economy macroeconomics: international trade theories, balance of payments, exchange rates.

53. **Indian Economic Development and Policy**
    - Growth and development: sustainability, human development, inclusive growth, regional disparities.
    - Demography: population trends, composition, demographic dividend, urbanisation.
    - Employment: occupational structure, unemployment types, employment schemes.
    - Sectoral performance: agriculture (productivity, credit, pricing), industry (MSME, FDI), services.
    - Policy framework: fiscal and monetary policies, centre-state finance, planning and reforms.

54. **Monetary and Financial System**
    - Money: concepts, functions, supply determination, RBI and high-powered money.

- Financial markets: call money, treasury bills, commercial bills, securities, primary & secondary markets.
- Stock market operations: indices, methodologies, BSE, NSE.
- Interest rates: theories, term structure, interest rates in India.
- Banking system: commercial banks, credit creation, monetary policy and RBI functions.

55. **Public Finance**
    - Fiscal functions: allocation, distribution, stabilization, welfare economics.
    - Public goods: characteristics, free rider problem, Lindahl equilibrium, public expenditure.
    - Externalities: corrective measures, Coase theorem, regulations, pollution control.
    - Taxation: incidence, excess burden, specific vs lump sum taxes, efficiency and equity.
    - Indian public finance: budget analysis, deficits, fiscal federalism, state-local finances.

56. **Environmental and Development Economics**
    - Environment and economy: market failure, externalities, Pigouvian tax, Coase theorem.
    - Environmental policy tools: tradable permits, joint forest management, global treaties.
    - Valuation methods: contingent valuation, travel cost method.
    - Sustainable development: strong/weak sustainability, Pearce–Atkinson indicator.

57. **Economic History of India (1857–1947)**
    - Colonial background: inheritance laws, socio-economic backwardness, drain theory.
    - Macro trends: national income, population, occupational structure, urbanisation, poverty.
    - Agriculture: land systems, markets, productivity, labour, famines, partition impacts.
    - Industry and transport: de-industrialisation, capitalist enterprise, railways, roads, labour policies.
    - Imperial economy: foreign capital, trade, public debt, provincial finance, guided underdevelopment.

58. **Introductory Economics**
    - Exploring economics: economic systems, models, scarcity and choice, incentives.
    - Demand and supply: price controls, elasticity, market efficiency, taxation.
    - Consumer choice: indifference curves, labour-leisure, consumption-savings decisions.
    - Production: cost concepts, economies of scale, firm behaviour.
    - Input markets: marginal productivity, labour markets, input demand.

59. **Introductory Macroeconomics**
    - Macro vs micro, GDP, GNP, national income components and deflators.
    - Income measurement: income, expenditure, product methods, circular flow.
    - Money and banking: quantity theory, Keynesian theory, credit, monetary policy.
    - Inflation and deflation: causes, consequences, measures, hyperinflation.
    - Income determination: Say's Law, Keynesian model, IS-LM model, multipliers.

**B.A. Non-Honours Political Science**

60. Introduction to Political Theory – Concepts: Democracy, Liberty, Equality, Justice, Rights, Citizenship, Civil Society, Debates.
61. Indian Government and Politics – Constitution, Parliament, PM, Judiciary, Caste, Class, Religion, Movements.
62. Comparative Government and Politics – UK, USA, Canada, China, Electoral Systems, Party Systems, Globalisation.

63. Introduction to International Relations – Realism, Neo-liberalism, Cold War, India's Foreign Policy, Global Powers.
64. Themes in Comparative Political Theory – Aristotle, Locke, Marx, Gandhi, Ambedkar, Lohia, Ramabai.
65. Administration and Public Policy – Public Administration, Theories, Policy Formulation, New Public Management.
66. Reading Gandhi – Hind Swaraj, Women's Question, Anti-Racism Movements.
67. Democratic Awareness with Legal Literacy – Constitution, Rights, Gender, Criminal Law, Lok Adalats.
68. Democracy and Governance – Parliament, Judiciary, Development Models, Civil Society.
69. Understanding Globalization – UN, WTO, G-77, Global Warming, Terrorism.
70. Human Rights, Gender and Environment – Inequality, Citizenship, Women's Movements, Environment Laws.
71. Conflict and Peace Building – Dimensions of Conflict, Peacebuilding, Mediation, Diplomacy, Media

**B.A. Non-Honours Education**

72. **Philosophical Foundations of Education**
    - Meaning, nature, and scope of education: formal, informal, non-formal
    - Aims and functions of education across different levels
    - Philosophy and education: aims, curriculum, methods, discipline
    - Indian schools of philosophy: Yoga, Vedanta, Buddhism and their educational impact
    - Western philosophies: Idealism, Naturalism, Pragmatism and their educational applications
    - Curriculum and co-curricular activities from philosophical perspectives

73. **Psychological Foundations of Education**
    - Educational Psychology: nature, scope, and significance
    - Schools of psychology: Behaviourism, Structuralism, Functionalism, etc.
    - Learning: types, theories (Thorndike, Pavlov, Skinner, Gestalt), motivation and memory
    - Intelligence: concepts, theories, emotional intelligence, creativity and giftedness
    - Personality and mental health: type and trait theories, instincts and adjustment

74. **Sociological Foundations of Education**
    - Educational Sociology: meaning, importance, theories (conflict, consensus)
    - Education and socialization: agencies, social mobility, modernization
    - Education and social change: culture, economy, development, human resource
    - Social groups in India: SC, ST, Women, Rural populations
    - Political ideologies and education: democracy, communism, secularism

75. **Emerging Trends in Indian Education**
    - Constitution and education: fundamental rights, directive principles, educational articles
    - Challenges at various levels: ECCE, elementary, secondary, higher, vocational, teacher education
    - Contemporary concerns: Environmental, Gender, Inclusive, Adult, Peace, Human Rights Education
    - ICT in education, curriculum issues, CCE, privatization and globalization
    - Role of international agencies: UNESCO, UNICEF, MDGs, EFA

76. **Great Educators and Educational Thought**
    - Ancient Indian thinkers: Shankaracharya, Yagyavalkya, Sankardeva
    - Modern Indian educators: Tagore, Vivekananda, Gandhi

- Western philosophers: Plato, Rousseau, Dewey, Derrida, Sartre
- Alternative education perspectives: Ivan Illich, Paulo Freire

77. **Measurement and Evaluation in Education**
    - Concepts of measurement and evaluation, types, formative/summative evaluation
    - Psychological testing: types, tools and characteristics
    - Achievement, intelligence, aptitude, and personality tests
    - Educational statistics: central tendency, variability, correlation, normal curve
    - Graphical data presentation: histograms, polygons, ogives

78. **Education in Pre-Independent India**
    - Ancient and medieval education systems: Vedic, Buddhist, Islamic
    - Missionary and East India Company educational initiatives
    - Key developments: Wood's Despatch, Hunter Commission, Wardha Scheme, Sargent Report

79. **Education in World Perspective**
    - Comparative education: nature, factors, methods
    - Education systems in USA, UK, Japan and India (curriculum, examination, administration)
    - Technical/vocational, teacher and distance education in global context

80. **Guidance and Counselling**
    - Concept, types and principles of guidance and counselling
    - Tools and techniques: tests, interviews, observations, sociometry
    - Educational and vocational guidance: role of teachers, headmasters, parents
    - Counselling for adjustment, special groups, organization of services

81. **Value and Peace Education**
    - Concepts and types of values, fostering values
    - Dimensions of value education and policy perspectives
    - Pedagogical approaches to value education
    - Peace education: objectives, pedagogy, global perspectives

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**SYLLABUS FOR B.SC. (CHEMISTRY HONOURS) WITH PHYSICS AND MATHEMATICS (POST CODE: GTCH12026)**

**CHEMISTRY (HONOURS):**

1. Bonding and structure: Ionic Bonding: Energy consideration in ionic bonding, lattice Energy. Born - Haber cycle and its application, polarizing power and polarizability. Fajan's rule, Bond moment, dipole moment and percentage ionic character. Hydrogen Bonding. Covalent Bonding: VB Approach-Concept of hybridization (sp, $sp^2$ , $sp^3$ , $sp^3d$, $sp^3d^2$ and $dsp^2$ ). VSEPR Theory. Resonance and Resonance energy: Study of some inorganic and organic compounds ($O_3$, $NO_3^-$ , $CO_3^{2-}$, $SO_4^{2-}$, $RCOO^-$ , $C_6H_6$). Co-ordinate or Dative Bond. Bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combination of atomic orbitals non-bonding combination of orbitals, MO treatment of homonuclear diatomic molecules and heteronucear diatomic molecules such as CO, NO and $NO^+$
2. Basics of Organic Chemistry: Organic Compounds: classification and Nomenclature. Hybridization: Shape of molecules, Influence of hybridization on bond properties. Electronic displacements: Inductive, Electromeric, Resonance, Mesomeric effects and Hyper conjugation and their applications. Dipole moment. Organic acids and bases: Their relative strength,Homolytic and Heterolytic fission, Electrophiles and Nucleophiles: Nucleophilicity and basicity. Reactive intermediates: Carbocations, carbanions, free radicals, carbenes, nitrenes, Types, Shape and their relative Stability. Energy profile diagrams of one step, two steps and three steps reactions, Rate limiting steps. Activation Energy. Kinetically and thermodynamically controlled reactions.
3. Optical isomerism: Concepts of asymmetry, dissymmetry, optical activity, Specific rotation, Chirality, enantiomers, Diastereomers, racemic mixture, racemization and Resolution, Threo and Erythro forms, Meso structures &Epimers. Relative and absolute configuration: D/L and R/S designations. Walden inversion.
4. Geometrical Isomerism: Restricted rotation about C=C bonds, physical and chemical properties of diasteroisomers, determination of configuration of geometrical isomers: cis-trans isomerism, syn-anti and E/Z notation with CIP rules. Geometrical isomerism in oximes and alicyclic compounds.
5. Atomic Structure: (Recapitulation of Bohr's Theory, de Broglie, Theory, Heisenberg Uncertainty Principle) Time independent Schrödinger wave equation (H=E). Significance of ¥ and ¥ $^2$ Schrodinger equation for Hydrogen atom (qualitative treatment only). Quantum numbers, Electronic configuration of elements based upon electronic configuration in the periodic table, periodic properties-effective nuclear charge, ionization energy, electron affinity, electronegativity (Pauling, Mulliken's and AllredRochow scales). Redox potential.
6. Aliphatic Hydrocarbons-1: Alkanes (upto 5 carbons) Preparation:- Catalytic hydrogenation, Wurtz reaction, Kolbe's Synthesis, from Grignard reagent. Corey-House Synthesis. Reactions: Free radial Substitution: Halogenations.
7. Metals: Theory of reduction (Thermodynamic approach), role of carbon and other reducing agents, electrolytic reduction, roasting and calcinations. Method of purification and refining of metals including modern methods like zone refining, vacuum arc process, ion exchange, solvent extraction and electrolytic method, Van- Arkel process andhydrometallurgy. Study of potassium dichromate, manganese dioxide, potassium permanganate, ammonium molybdate, sodium cobaltinitrite, cobalt nitrate, Ni-DMG, vanadium pentoxide).
8. Chemical Thermodynamics -I: Extensive and intensive properties of a system, thermodynamic processes: cyclic, reversible, irreversible processes, thermodynamic function, complete differential, Zeroth law of thermodynamics. First law of thermodynamics-internal energy, enthalpy, molar heat capacities, relation between Cp and Cv, work of expansion in reversible and irreversible process, adiabatic process, relation between P, V, T. Variation in internal energy and enthalpy with temperature, Joule Thomson effect, calculation of Joule Thomson co-efficient for ideal and Vander Waal's gas. Thermo chemistry- Hess's law, Kirchhoff's law relation of reaction enthalpy with internal energy, Bond energy and Bond dissociation energy, calculation from thermo chemical data.
9. Carbon- Carbon sigma bonds: Chemistry of Alkanes: Formation of alkanes with special emphasis on Corey House Synthesis, Wurtz reaction, Wurtz-Fittig reaction. Reactions of alkanes: Free Radical substitution:- Halogenations-relative reactivities and selectivity.

10. Carbon-Carbon pi bonds: Formation of alkenes and alkynes by Elimination: Mechanism of E1., E2, E1cB reactions. Saytzeff and Hoffmann elimination, special emphasis on preparation of alkenes by synelimination:- pyrolysis of esters, Chugaev reaction and Wittig reaction.
11. Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A, Vitamin B, Vitamin C, Vitamin D, Vitamin E & Vitamin K.
12. Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition and uses.
13. Proteins: Sources, Composition and Biological values of protein, Elementary ideas of proteins and amino acids, Essential and Non-essential amino acids. Peptide bonds, Polypeptides, Qualitative ideas of structure of proteins (Primary, secondary, Tertiary and Quaternary structure), Denaturation and coagulation of proteins; Factors contributing to denaturation and coagulation of proteins.
14. Petroleum and Petrochemical Industry: Composition of crude petroleum; Different types of petroleum products and their applications. Principle and process of fractional distillation, Cracking - Thermal and catalytic cracking; Qualitative treatment of non-petroleum fuels -LPG, CNG, LNG, bio-gas, fuels derived from biomass, fuel from waste; synthetic fuels -gaseous and liquids.
15. d and f block elements: General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Electronic configuration, oxidation states, colour, spectral and magnetic properties of lanthanides and actinides. Lanthanide contraction, separation of lanthanides (ion-exchange method only).
16. Ionic equilibrium: Strong and weak electrolyte with modern classification of electrolytes (true and potential electrolyte), degree of ionization, factors affecting degree of ionization, ionization constant, ionic product of water, ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, buffer solution, derivation of Henderson equation and its applications, buffer capacity, buffer range, buffer action. Solubility and solubility product of sparingly soluble salts-application of solubility product principle in salt analysis. Qualitative treatment of acid-base titration curves. Theory of acids- base indicators, selection of indicators and their limitations.
17. Conductance: Arrhenius theory of electrolytic dissociation, conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes, molar conductivity at infinite dilution, Kohlrausch law of independent migration of ions, Debye-Huckel - Onsagar equation, Wien effect, Debye-Falkenhagen effect, Walden's rule. Ionic mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and moving boundary methods (principle only , calculations not required), anomalous transference number, application of conductance measurement: i) degree of dissociation of weak electrolytes ii) ionic product of water iii) solubility and solubility product of sparingly soluble salts iv) Hydrolysis constant of aniline hydrochloride, v) Conductometric titration (Acid-Base and precipitation).
18. Aromatic Hydrocarbons Aromaticity: Huckel's rule, aromatic characters of arenes, benzenoid, non-benzenoid- aromatic compounds and heterocyclic and polynuclear hydrocarbons with suitable examples Synthesis and properties of naphthalene and anthracene. Antiaromaticity and nonaromaticity Electrophilic Aromatic Substitution: Halogenation, nitration, sulphonation and Friedelcraft's alkylation / acylation with their mechanism. Activation/deactivation of aromatic ring and directing effects of groups. Partial rate factor (O/P ratio)
19. Silicate Industries: Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass. Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre. Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.
20. Polymers Introduction and classification of polymers; Polymerisation reactions -Addition and condensation - Mechanism of cationic, anionic and free radical addition polymerization; Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene); Fabrics – natural and

synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Biodegradable polymers with examples.

21. Quantum Chemistry-I: Background of quantum mechanics; Black body radiation – Planck's hypothesis, photoelectric effect, de Broglie hypothesis and Heisenberg's uncertainty principle. Postulates of quantum mechanics, quantum mechanical operators (Linear and Hermitian operators), Wave functions, Normalized and Orthogonal Wave Functions. Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy; wave functions, probability distribution functions, nodal properties, separation of variables, two- and three-dimensional boxes, degeneracy. Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy. Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component. Rigid rotator model of rotation of diatomic molecule:Schrödinger equation and its solution. Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, energy (only final energy 30 0 - 30 Page 60 of 128 expression). Average and most probable distances. Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).
22. Nuclear Chemistry: Nuclear structure, Mass defect, Binding energy and stability of nuclei, Nuclear transmutations and Artificial radioactivity, Fundamentals of radioactive decay, Nuclear reactions including fission and fusion reactions, Analytical applications of Nuclear Reactions and Radioactive tracers
23. Electrical & Magnetic Properties of Atoms and Molecules Basic ideas of electrostatics, Electrostatics of dielectric media, Clausius-Mosotti equation, Debye equation, Lorentz-Laurenz equation, Dipole moment and molecular polarizabilities and their measurements. Diamagnetism, paramagnetism, Ferromagnetism and Antiferromagnetism and their molecular interpretation, Magnetic susceptibility and its measurement.
24. Electrochemistry: Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: $\Delta G$, $\Delta H$ and $\Delta S$ from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. P H determination using hydrogen electrode and quinhydrone electrode. Commercial applications of galvanic cell, dry cell, lead storage battery, fuel cell.
25. Colloidal state Electro kinetic phenomenon- electrophoresis, electroosmosis, electrical double layer and zeta potential, theory of stabilities of colloids, protective action of Lyophillic sol-gold number, determination of Avogadro's number, coagulation of colloids, Schultz – Hardy rule, association of colloids, emulsions, micelles and their structure, critical micelles concentration, Donnan membrane equilibria.
26. Carbohydrates: Occurrence, classification, and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Ascending and descending in monosaccharide; Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation.
27. Infrared and Raman spectroscopy: Classical equation of vibration, vibrational energies of diatomic molecules, zero point energy, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, effect of isotopic substitution, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. Raman Effect, Classical and Quantum theory of Raman scattering, Polarizability tensor, Rayleigh and Raman scattering, Stokes and antistokes lines, structure elucidation by Raman spectroscopy (AB, A2B, and AB3), stretching frequencies of bonds and functional groups (Example from both organic and inorganic molecules), Rule of Mutual Exclusion, Depolarization ratio.
28. Amines & Diazonium salts: Amines (Aliphatic and Aromatic) : Preparation – from alkyl halides, Gabriel's Phthalimide Synthesis, Hofmann Bromamide Reaction Reactions: Hofmann vs Saytzeff

elimination, Carbylamine Test, Hinsberg test, with $HNO_2$, electrophiicSubstiution( in case of aniline) : Nitration, Bromination, Sulphonation. Diazonium Salts: Preparation from Aromatic Amines, Synthetic uses of benzene diazonium chloride including preparation of Dyes - Coupling Reaction.

29. Materials Chemistry: synthesis and modification of inorganic solids: general principle of solid-state reaction, experimental procedure (co-precipitation, solgel, hydrothermal, Intercalation etc.), preparation of crystalline materials, nucleation, crystal growth, graphite and zirconium intercalation compounds, transition metal chalcogenide, thin films, growth of single crystals. Catalyst immobilization onto silica andclay surfaces and applications, pillaring of certain clays. Electronic and optical properties ofsome inorganic and organic solids (solid electrolytes, inorganic-coloured solids, white and black pigments). Design and properties of composites, polymer matrix andcarbon-carbon composites. Brief idea about drilling muds.
30. Crystallization and Crystallinity, Determination of Crystalline melting point and degree of Crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. Nature and structure of polymers-Structure Property relationships. Determination of molecular weight of polymers (Mn, Mw, etc), by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

**B.SC. (PHYSICS NON-HONOURS)**

31. Mechanics – Motion, force, energy, SHM, rotational motion, elasticity, special relativity
32. Electricity and Magnetism – Vector analysis, Gauss's and Ampere's law, electromagnetic waves
33. Thermal Physics and Statistical Mechanics – Laws of thermodynamics, entropy, kinetic theory, radiation
34. Waves and Optics – SHM, resonance, interference, diffraction, polarization
35. Digital & Analog Circuits and Instrumentation – Logic gates, semiconductors, amplifiers, CRO
36. Basic Instrumentation Skills / Computational Physics Skills
37. Elements of Modern Physics / Solid State Physics / Quantum Mechanics – Photoelectric effect, Schrödinger eqn., nuclear models
38. Renewable Energy

**B.SC. (NON-HONOURS) MATHEMATICS**

## 39. Differential Calculus

- Limits and Continuity, Types of Discontinuity, Partial Differentiation, Euler's Theorem
- Tangents, Normals, Curvature, Asymptotes, Curve Tracing in Cartesian, Parametric and Polar Coordinates
- Taylor's and Maclaurin's Series, Rolle's and Mean Value Theorems, Maxima and Minima
- Exact Equations, Higher Order Equations, Linear Differential Equations, Wronskian
- Linear Equations with Constant Coefficients, Cauchy-Euler Equations, Variation of Parameters
- Partial Differential Equations – Lagrange's and Charpit's Methods, Classification of PDEs

## 40. Real Analysis

- Real Line and Completeness, Sequences and Series, Convergence Tests
- Cauchy Criterion, Monotone Sequences, Power Series, Uniform Convergence
- Pointwise and Uniform Convergence of Functions, Integrability, Differentiability

## 41. Algebra

- Groups, Subgroups, Cyclic Groups, Permutation Groups, Quotient Groups
- Rings and Fields – Definitions, Subrings, Ideals, Fields of Rational and Real Numbers

## 42. Matrices

- Vector Spaces, Basis, Rank of Matrix

- Matrix Transformations and Geometry, Eigenvalues and Eigenvectors
- Diagonalization, Matrix Inversion, Solutions of Systems of Linear Equations

## 43. Logic and Sets

- Propositional Logic, Truth Tables, Logical Connectives, Quantifiers
- Set Theory – Operations, Power Set, Relations and Equivalence Relations

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**SYLLABUS FOR B.SC. (BOTANY HONOURS) OR B.SC. (ZOOLOGY HONOURS) WITH CHEMISTRY (POST CODE:GTBL12026)**

**B.SC. (BOTANY HONOURS)**

1. Natural resources: Definition and types. Natural resources of NE India. Renewable and non-renewable sources of energy.
2. History of tea cultivation, classification; Botany of tea plant, morphology and anatomy of tea plants; Climate and tea production, temperature, rainfall, humidity, sunshine, shade trees, soil characteristics, organic matter, soil nutrients, nutrients application.
3. Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.
4. Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, process of nitrogen fixation, blue green algae and Azollain rice cultivation.
5. Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.
6. Introduction to Orchids: Salient features, habitat, origin and diversity, morphology and classification of orchids, Economic importance of Orchids.
7. Common and endemic Orchids of North East India: status and distribution; RET species of Orchids of India with special reference to NE India
8. The cell: Cell as a unit of structure and function; cell theory, Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).
9. Cell wall and plasma membrane: Chemistry, structure and function of Plant cell wall; Overview of fluid mosaic model; Chemical composition of membranes; membrane function.
10. Cell organelles: Nucleus; Structure-nuclear envelope, nuclear pore complex, nuclear lamina, organization of chromatin; nucleolus. Microtubules, microfilaments and intermediary filament. Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast; Ribosomes- types, components and function; Lysosomes. Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, Golgi Apparatus.
11. Biomolecules: Types and significance of chemical bonds; Structure and properties of water; pH and buffers. Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides. Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides. Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quarternary; Protein denaturation and biological roles of proteins. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.
12. Enzymes: Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theroy), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.
13. Genetic material and its organization: DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & Mc Carty experiment); denaturation and renaturation of DNA,; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. RNA Structure; Organelle DNA-mitochondria and chloroplast DNA.
14. Ayurveda: History, origin, Pancha mahabhutas, Saptadhatu andTridoshaconcepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinalsystems, Basis of Siddha system, plants used in Siddha medicine.

**B.SC. (ZOOLOGY HONOURS)**

15. 1) Study of the following specimens: Protista: Amoeba, Euglena, Plasmodium, Paramecium Cindaria: Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora and One specimen/slide of any ctenophore Annelids: Nereis, Aphrodite, Chetopterus, Pheretima, Hirudanaria Arthropods:Limulus,Belastoma, Palamnaeus, Daphnia, Palaemon, Cancer, Brachionus, Bombyx, Periplaneta, Samia ricini. Antherae spp.Termite and honey bee. Helminths: Ascaris, Taenia, Fasciola. Molluscs:Chiton,Dentalium,Pila,Doris,Helix,Unio, Sepia, Octopus and Nautilus. Echinoderms: Pentaceros, Asterias, Ophiura, Echinus, Antedon 2) Study of Sycon(T.S. and L.S.), Hyalonema, Euplectella,Spongilla 3) Study of whole mount of Euglena, Amoeba and Paramecium, Binary fission and Conjugation in Paramecium. 4) Study of mouth parts of Periplaneta 5) Study of adult Fasciola hepatica, Taenia solium and their life cycles (Slides/micro- photographs) 6) Study of adult Ascaris lumbricoides and its life stages(Slides/micro-photographs). 7) Study of septal nephridia in earthworm, digestive system of Periplaneta (virtual).
16. Overview of cell: Prokaryotic and Eukaryotic cells: Plasma Membrane and Cytoskeleton: Various models of plasma membrane structure, Transport across membranes: Active and Passive transport, Cell junctions: Tight junctions, Desmosomes, Gap junctions, Structure and Functions: Microtubules, Microfilaments and Intermediate filaments
17. Mitochondria and Peroxisomes: Mitochondria: Structure,Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis,Peroxisomes
18. Nucleus: Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome).
19. Cell Division and Cell Signalling Mitosis, Meiosis, Cell cycle and its regulation, GPCR and Role of second messenger (cAMP).
20. Digestive System and Urinogenital System Alimentary canal and associated glands, dentition Succession of kidney, Evolution of urinogenital ducts, Types of mammalian urinogenital system
21. Nervous System and Sense Organ Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals Classification of receptors Brief account of visual and auditory receptors in man
22. Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity
23. Non-infectious diseases: Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit Infectious diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis
24. Introduction to Biochemistry, scopes; chemical basis of life, functional groups; water as solvent, ionization of water, weak acids; pH, buffer solution; types of chemical bonds in biological systems and types of biomolecules (Macro and small molecules) and functions. Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions, ATP- structure and role as energy currency molecule.
25. Proteins: Classification and functions of proteins. Amino acids, properties, and functions. Peptide bonds and peptide groups; structural organization of proteinprimary, secondary, tertiary, and quaternary. The structural and functional relationship of proteinRibonuclease-A, myoglobin, hemoglobin; protein denaturation and renaturation.
26. Carbohydrates: Sources, and biological functions; Classification- monosaccharide, disaccharide, and polysaccharide. Classes and structure of mono and disaccharides, glycosidic bond: Stereoisomerism, mutarotation, anomer, epimer etc.; glycoproteins and glycolipids. Lipids: Structure, classification, and biological functions of lipids; storage and membrane lipids, lipoprotein. Fatty acids: classification; saturated, unsaturated, polyunsaturated; essential and non-essential fatty acids.
27. Historical Review of Evolutionary Concepts and Beginning of Life and Evidences of Evolution: Lamarckism, Darwinism, Neo-Darwinism, Chemogeny, RNA world, biogeny, endo-symbiotic theory, Palaeontological: geological time scale; phylogeny of horse; Molecular: neutral theory of evolution, example of globin gene family, rRNA/Cyt c.
28. Applications of Biotechnology: Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice);

transgenic animals; Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns.

**B.SC. (CHEMISTRY NON-HONOURS)**

29. Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons
30. Chemical Energetics, Equilibria and Functional Group Organic Chemistry
31. Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry
32. Transition Metals, Coordination Chemistry, States of Matter and Chemical Kinetics

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**SYLLABUS FOR BACHELOR OF LIBRARY AND INFORMATION SCIENCE (POST CODE: LBRN12026)**

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1. **Library, Information and Society**
   - Library as a Social Institution, Development of Libraries in India
   - Role of Library and Information Centres in Modern Society
   - Five Laws of Library Science
   - Types of Libraries, Professional Associations (ILA, IASLIC, ALA, SLA etc.)
   - Organizations: RRRLF, UNESCO, IFLA
   - Library Legislation in India and Model Library Act
   - Press and Registration Act, Delivery of Books (Public Libraries) Act
   - Information Characteristics and Communication Models
   - Role of Library Professionals in the Digital Era

2. **Library Classification (Theory)**
   - Concepts, Need, Purpose and Functions
   - Normative Principles, Facet Analysis and Sequence
   - Devices in Classification, Notation, Call Number
   - Classification Schemes: DDC, UDC, CC
   - Current Trends in Library Classification

3. **Library Classification (Practical)**
   - Colon Classification (Ed. 6): Basic to Complex Subjects
   - Dewey Decimal Classification: Tables 1 to 7
   - Use of Common Isolates, Phase Relations, Relative Index

4. **Basics of Information Technology in LIS (Theory)**
   - Computer Generations, Architecture, OS (DOS, Windows, Linux)
   - Library Automation: Acquisition, Cataloguing, Circulation, OPAC
   - Library Software: WINISIS, SOUL, Alice for Windows
   - Metadata Standards: CCF, MARC 21, Dublin Core
   - Database Management and Internet Search Techniques

5. **Basics of Information Technology in LIS (Practical)**
   - Operating Systems Installation, MS Office Tools
   - Database Creation and Web Interface (GENISIS)
   - Library Software Installation and Configuration
   - Advanced Internet Searching, Meta Search Engines

6. **Project Work: Literature and Field Survey**
   - Literature Searching using Print and Online Sources
   - Preparing Bibliographies and Documentation Lists
   - Exposure to Library Operations and Reporting

7. **Management of Library and Information Centres**
   - Library Planning and Organisation
   - Human Resource and Financial Management
   - Library Building, Collection Development
   - Library Circulation, Maintenance and Statistics

8. **Information Sources and Services**
   - Types of Information Sources: Primary, Secondary, Tertiary
   - Reference and Information Services
   - Documentation and Alert Services (CAS, SDI etc.)
   - Information Literacy Programme and User Categories

9. **Library Cataloguing (Theory)**
   - History, Functions, Forms and Types of Catalogues
   - Types of Entries, Filing Rules
   - Headings for Authors, Titles, Non-Print Resources
   - Subject Cataloguing, LCSH, SLSH
   - Trends in Cataloguing, Standards: ISBD, MARC

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# SYLLABUS FOR ECONOMICS (POST CODE: PGEC12026)

1. **Microeconomics**
   - Production Possibility Curve
   - Consumer's Equilibrium – Total Utility, Marginal Utility, Conditions of Equilibrium
   - Relationship between Total Utility and Marginal Utility
   - Indifference Curve – Properties, Budget Set and Line, Indifference Map
   - Demand – Law of Demand, Demand Curve, Price Elasticity and its Degrees
   - Methods of Measuring Elasticity – Percentage and Point Elasticity, Factors Affecting Demand
   - Producer Behaviour – Total, Marginal and Average Product, Returns to Factor
   - Cost – Total, Marginal, Average Cost; Fixed and Variable Inputs, Cost Relationships
   - Revenue – Total, Average and Marginal Revenue, Producer's Equilibrium (TR-TC and MR-MC Approach)
   - Supply – Law of Supply, Supply Curve, Price Elasticity of Supply
   - Market Structures – Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly
   - Price Controls – Price Ceiling, Price Floor

2. **Macroeconomics**
   - National Income – GDP, Direct and Indirect Tax Concepts
   - Methods of Estimating National Income – Income, Expenditure, and Value Added Methods
   - GDP at Constant and Current Prices, GDP Deflator
   - Aggregate Demand and Supply – Components, Effective Demand
   - Consumption and Saving – Average and Marginal Propensity, Linear Functions
   - Equilibrium Income using AD-AS Approach, Investment Multiplier
   - Banking – Repo Rate, Reverse Repo Rate, CRR, SLR, LRR
   - Government Budget – Components, Classification of Receipts and Expenditures
   - Balance of Payment and Foreign Exchange – Components, Exchange Rate Systems, Appreciation/Depreciation, Revaluation/Devaluation

3. **Indian Economic Development**
   - Industrial Policy Resolution 1956
   - Five-Year Plans
   - NITI Aayog and Planning Commission
   - Economic Reforms of 1991

4. **Statistics for Economics**
   - Arithmetic Mean
   - Median
   - Mode
   - Index Numbers
   - Correlation

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**SYLLABUS FOR M.SC. (PHYSICS) (POST CODE: PGPH12026)**

1. **Mathematical Physics**
   - Vector analysis – gradient, divergence, curl, vector identities
   - Matrices – diagonalization, eigenvalues and eigenvectors
   - Fourier series and Fourier transforms
   - Dirac delta function, complex analysis – residues and contour integration
   - Ordinary and partial differential equations – methods and applications
   - Special functions – Legendre, Bessel and Hermite functions
   - Probability theory and statistics in physics

2. **Classical Mechanics**
   - Newton's laws, conservation laws and their applications
   - Generalized coordinates, Lagrangian and Hamiltonian formulations
   - Central force motion – Kepler's laws, effective potential
   - Rigid body dynamics, moment of inertia tensor
   - Small oscillations and normal modes

3. **Quantum Mechanics**
   - Postulates of quantum mechanics
   - Wave function and probability interpretation
   - Heisenberg uncertainty principle
   - Schrödinger equation – time-dependent and time-independent forms
   - Operators, eigenvalues, expectation values, commutation relations
   - Solutions for potential well, harmonic oscillator, hydrogen atom

4. **Condensed Matter Physics**
   - Crystal structure and Bravais lattices
   - X-ray diffraction and reciprocal lattice
   - Bonding in solids – ionic, covalent, metallic, Van der Waals
   - Band theory of solids – conductors, semiconductors, insulators
   - Magnetism – dia, para, and ferromagnetism
   - Superconductivity – Meissner effect and BCS theory

5. **Electrodynamics**
   - Electrostatics – Gauss's law, Laplace and Poisson equations
   - Magnetostatics – Biot-Savart law, Ampère's law
   - Maxwell's equations and electromagnetic waves
   - Potentials and gauge transformations
   - Radiation from an accelerated charge, Liénard–Wiechert potentials
   - Waveguides and transmission lines

6. **Atomic & Molecular Physics**
   - Bohr model and corrections
   - Zeeman effect and Stark effect
   - LS and JJ coupling, fine structure of hydrogen
   - Spectroscopic techniques and selection rules
   - Molecular energy levels – rotational, vibrational and electronic transitions
   - Raman effect and Franck-Condon principle

7. **Nuclear Physics**
   - Nuclear properties – size, mass, binding energy
   - Nuclear models – liquid drop, shell model

- Radioactive decay – alpha, beta, gamma decay
- Nuclear reactions – cross-sections, Q-value, compound nucleus
- Fission and fusion, nuclear reactors and applications

**8. Statistical Mechanics**

- Microstates, macrostates, and statistical ensembles
- Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distributions
- Partition function and thermodynamic quantities
- Classical and quantum statistics
- Blackbody radiation and specific heat of solids
- Phase transitions and critical phenomena

**9. Plasma Physics**

- Plasma definition and characteristics
- Debye shielding, plasma oscillations
- Magnetohydrodynamics (MHD) and waves in plasma
- Applications of plasma – fusion, space physics, plasma diagnostics

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**SYLLABUS FOR M.SC. (MATHEMATICS) (POST CODE: PGMA12026)**

1. **Sets**
   - Sets and their representations, Empty set, Finite & Infinite sets, Equal sets, Subsets
   - Power set, Universal set, Venn diagrams, Union and Intersection of sets
   - Difference and Complement of a set

2. **Relations and Functions**
   - Ordered pairs, Cartesian product of sets, number of elements in Cartesian product
   - Definition of relation, pictorial diagrams, domain, co-domain and range
   - Real valued functions – constant, identity, polynomial, rational, modulus, signum, greatest integer
   - Operations on functions – sum, difference, product and quotient
   - Mappings – one-one, into, onto, composition of mappings, equivalence relations

3. **Permutation and Combination**
   - Fundamental principle of counting, factorial notation
   - Permutations and combinations – simple applications

4. **Complex Numbers**
   - Algebraic properties, Argand plane, polar form, Modulus and Argument
   - Fundamental Theorem of Algebra, solution of quadratic equations in complex numbers
   - Square root of complex numbers

5. **Linear Inequalities**
   - Algebraic and graphical solution of linear inequalities in one and two variables
   - System of linear inequalities – graphical solution
   - Absolute value, Inequality of means, Cauchy-Schwarz, Tchebychev's Inequalities

6. **Binomial Theorem**
   - Statement and proof for positive integers, Pascal's Triangle
   - General and middle terms, simple applications

7. **Sequence and Series**
   - A.P., G.P., H.P., General terms and sums
   - A.M., G.M., H.M. and their relations
   - Insertion of means, special series

8. **Quadratic Equations**
   - Real and complex roots, relations between roots and coefficients
   - Nature of roots, formation of quadratic equations

9. **Matrices and Determinants**
   - Matrices and determinants of order 2 and 3, properties
   - Evaluation of determinants, area of triangle
   - Matrix operations, adjoint and inverse, solving linear equations

10. **Two Dimensional Geometry**
    - Cartesian coordinates, distance, section formula, area, collinearity
    - Centroid, in-centre, slope, intercepts, equations of lines, angle between lines
    - Distance from a point, internal/external bisectors, concurrency of lines
    - Conics – parabola, ellipse, hyperbola, tangents and points of tangency

11. **Trigonometric Functions**
    - Angle measurement in degrees/radians, unit circle definitions
    - Graphs, compound angles, identities (double/triple angle)
    - Trigonometric equations, sine and cosine laws, triangles, heights and distances

12. **Inverse Trigonometric Functions**
    - Definition, domain, range, principal values, graphs, elementary properties

13. **Differential Calculus**
    - Limits, continuity, differentiability
    - Derivatives of basic, composite, inverse, parametric functions
    - Second derivatives, Rolle's and Lagrange's Theorems

14. **Applications of Derivatives**
    - Rate of change, increasing/decreasing functions, tangents, normals
    - Approximations, maxima and minima

15. **Integral Calculus**
    - Indefinite integrals – basic functions, methods (substitution, parts, partial fractions)
    - Definite integrals – properties, evaluation, Fundamental Theorem of Calculus
    - Applications – area under curves, between curves

16. **Differential Equations**
    - Order, degree, general and particular solutions
    - Formation, methods – separation of variables, homogeneous, linear equations

17. **Vectors**
    - Definition, magnitude, direction, direction cosines/ratios
    - Types of vectors, position vector, operations (addition, scalar multiplication)
    - Dot and cross product, projection

18. **Statistics**
    - Mean, median, mode – grouped and ungrouped data
    - Measures of dispersion – mean deviation, variance, standard deviation
    - Correlation

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**SYLLABUS FOR ENGLISH (POST CODE: PGEN12026)**

# Literature and Critical Thought: Periods, Movements, and Themes

## 1. Late Medieval to Elizabethan (14th–16th Century)

- Chivalric Romance & Allegory – Sir Gawain and the Green Knight, Piers Plowman
- Religious and Moral Literature – The Book of Margery Kempe, Everyman (Morality Play)
- Early Renaissance Humanism – Utopia (Thomas More), Sonnets of Wyatt and Surrey
- Elizabethan Drama & Poetry – Doctor Faustus (Marlowe), Astrophil and Stella (Sidney), The Faerie Queene (Spenser)

## 2. Jacobean to Pre-Restoration (1603–1660)

- Metaphysical Poetry – The Flea, The Good Morrow (John Donne), The Collar (George Herbert)
- Caroline Drama and Tragedy – The Duchess of Malfi (John Webster), Volpone (Ben Jonson)
- Religious and Political Prose – Areopagitica (Milton), Leviathan (Hobbes)
- Epic and Visionary Literature – Paradise Lost (John Milton)

## 3. Restoration and the Eighteenth Century (1660–1798)

- Restoration Comedy & Satire – The Way of the World (Congreve), Absalom and Achitophel (Dryden)
- Neo-Classicism & Reason – An Essay on Criticism, The Rape of the Lock (Alexander Pope)
- The Rise of the Novel – Robinson Crusoe (Defoe), Pamela (Richardson), Tom Jones (Fielding)
- Political and Philosophical Thought – A Modest Proposal (Swift), The Social Contract (Rousseau)

## 4. The English Romantics (1798–1832)

- Nature and Imagination – Lines Composed...Tintern Abbey (Wordsworth), Kubla Khan (Coleridge)
- Revolution and Individualism – Prometheus Unbound (Shelley), Childe Harold's Pilgrimage (Byron)
- The Gothic and the Sublime – Frankenstein (Mary Shelley), The Castle of Otranto (Horace Walpole)
- Odes and Aestheticism – Ode to a Nightingale, Ode on a Grecian Urn (Keats)

## 5. The Victorian Age (1832–1901)

- Industrialism and Social Reform – Hard Times (Dickens), North and South (Gaskell)
- Faith, Doubt, and Morality – In Memoriam (Tennyson), Dover Beach (Arnold)
- The Woman Question – Jane Eyre (Charlotte Brontë), The Subjection of Women (J.S. Mill)
- Aestheticism and Decadence – The Picture of Dorian Gray (Wilde), The Blessed Damozel (Rossetti)

## 6. Classical Criticism to the New Critics

- Classical Foundations – Poetics (Aristotle), The Art of Poetry (Horace)
- Renaissance and Neoclassical Criticism – An Apology for Poetry (Sidney), An Essay on Dramatic Poesy (Dryden)
- Romantic Criticism – Biographia Literaria (Coleridge), Preface to Lyrical Ballads (Wordsworth)
- New Criticism – The Well-Wrought Urn (Cleanth Brooks), Seven Types of Ambiguity (Empson)

## 7. The Modern Age (1901–1945)

- Modernist Experimentation – The Waste Land (T.S. Eliot), Ulysses (Joyce)
- The Stream of Consciousness Novel – Mrs. Dalloway (Woolf), To the Lighthouse
- Alienation and Fragmentation – The Trial (Kafka), Waiting for Godot (Beckett)
- War Literature – All Quiet on the Western Front (Remarque), Goodbye to All That (Graves)

## 8. Postcolonial Literature

- Empire and Resistance – Things Fall Apart (Achebe), A Passage to India (Forster)
- Diaspora and Identity – The Mimic Men (Naipaul), The Satanic Verses (Rushdie)
- Postcolonial Feminism – So Long a Letter (Mariama Bâ), Woman at Point Zero (Nawal El Saadawi)
- Hybridity and Language Politics – Decolonising the Mind (Ngũgĩ wa Thiong'o)

## 9. Critical Theory

- Structuralism and Semiotics – Course in General Linguistics (Saussure), Mythologies (Barthes)
- Marxist Theory – The German Ideology (Marx & Engels), Ideology and Ideological State Apparatuses (Althusser)
- Feminist Theory – The Second Sex (Beauvoir), The Laugh of the Medusa (Cixous)
- Poststructuralism and Deconstruction – Of Grammatology (Derrida), The Death of the Author (Barthes)

## 10. European Literature

- French Realism and Existentialism – Madame Bovary (Flaubert), The Stranger (Camus)
- German Romanticism and Modernism – Faust (Goethe), The Magic Mountain (Mann)
- Russian Literature and the Human Condition – Crime and Punishment (Dostoevsky), The Cherry Orchard (Chekhov)
- Italian Renaissance and Satire – The Divine Comedy (Dante), The Prince (Machiavelli)

## 11. Indian Writing in English

- Nationalism and Colonial Legacy – Kanthapura (Raja Rao), Train to Pakistan (Khushwant Singh)
- Post-Independence Identity – Midnight's Children (Rushdie), The God of Small Things (Arundhati Roy)
- Women's Writing – Clear Light of Day (Anita Desai), Difficult Daughters (Manju Kapur)
- Dalit and Subaltern Voices – Joothan (Omprakash Valmiki), Karukku (Bama)

## 12. American Literature

- Transcendentalism – Walden (Thoreau), Leaves of Grass (Whitman)
- The American Dream and Disillusionment – The Great Gatsby (Fitzgerald), Death of a Salesman (Miller)
- Harlem Renaissance and Race – The Souls of Black Folk (Du Bois), Their Eyes Were Watching God (Hurston)
- Contemporary Multiculturalism – Beloved (Toni Morrison), The Joy Luck Club (Amy Tan)

## 13. English Language Teaching (ELT)

- Methods and Approaches – Grammar-Translation Method, Communicative Language Teaching (CLT)
- Curriculum and Syllabus Design – Structural vs. Functional Syllabi
- Assessment and Evaluation – Formative and Summative Assessment, Testing Listening and Speaking
- Technology in ELT – CALL (Computer-Assisted Language Learning), Blended Learning

## 14. Women and Literature

- Feminist Autobiography and Memoir – A Room of One's Own (Woolf), I Know Why the Caged Bird Sings (Angelou)
- Gender and Identity – The Awakening (Chopin), Wide Sargasso Sea (Rhys)
- Women's Poetry and Voice – Works of Sylvia Plath, Adrienne Rich, Kamala Das
- Intersectionality and Activism – This Bridge Called My Back (Moraga & Anzaldúa)

## 15. Translation Studies

- Theories of Translation – Equivalence, Skopos Theory, Postcolonial Translation Theory
- Translation and Power – Translation as Rewriting (Lefevere), The Translator's Invisibility (Venuti)
- Indian Translation Discourse – Tamas (Bhisham Sahni, tr. Jai Ratan), Gitanjali (Tagore)
- Gender and Translation – Gender in Translation (Sherry Simon), Feminist Translation Practices

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# SYLLABUS FOR EDUCATION (POST CODE: PGED12025)

1. Concept and Aims of Education:

   - Meaning, definition, scope and types of Education
   - Aims of Education - Individual, Social, Vocational and Democratic Aim.
   - Relation with Biology, Sociology, Philosophy, Economics and Statistics.

2. Stages of Human Development;
   - Infancy
   - Childhood
   - Adolescence

3. Psychology and Education:
   - Concept, Scope and relation between Education and Psychology
   - Educational Psychology and its significance
   - Schools of Psychology-
     - Behaviorism
     - Gestalism
     - Psycho-analysis
     - Structuralism
     - Functionalism
     - Contemporary Schools-Humanist (Maslow, Rogers, Allport), Trans personal Psychology; Cognitive psychology.
   - Growth and Development: Meaning, Nature and principle, of Growth and development of the children.
   - Learning-Meaning and principles of Learning, Gagne's Hierarchy of learning.

     - Theories of Learning: connectionist or Behaviorist theories, Thorndike's theory, Guthrie's Contiguity theory, Pavlov's classical Conditioning theory and Skinner's operant Conditioning theory.
     - Cognitive theories: theory of Insightful learning, Lewin's Field theory, Tolwan's sign gestalt learning, Bandura's Social Learning theory.
   - Intelligence
   - Social intelligence
     - Emotional Intelligence
     - Approaches to Intelligence -
       - Uni- factor theory
       - Two-factor theory
       - Multifactor theory
4. Theories of Intelligence-
   - Sternberg's information processing theory
   - Gardner's theory of multiple intelligence.
5. Assessment of intelligence
   - Personality:
     - Concept of Personality
     - Theories of Personality
       - Freud's Psycho-analytic theory
       - Carl Rogers theory
       - Gorden Allport theory
     - Assessment of Personality -
       - observation
       - Interview
       - The Questionnaire method
       - Personality inventory
       - Rating scales
       - Case history
       - Psycho-Analysis
       - Projective Techniques (TAT), Rorschach Test
     - Guidance and counseling

- ❖ Nature, Principles and Need of guidance & counseling in education.
- ❖ Inclusive Education
- ❖ Types of Guidance (Educational, Vocational, personal, health and Social)

- Environmental Education and sustainable. Development :
  - ➢ Concept of environment, relationship of environment and education
  - ➢ Concept, scope and importance of Environmental Education.
  - ➢ Aims and objectives of Environmental Education
  - ➢ Guiding principles of Environmental Education
  - ➢ Difference between Environmental Education and Environmental Awareness.
  - ➢ Ecosystem concept, characteristics, kinds, Function, Man as a part of ecosystem.
  - ➢ Biodiversity-Concept and value.

6. Concept of Open and Distance Learning (ODL)→
   - Nature and Characteristics of ODL
   - Correspondence, Open and Distance Education

7. Mental Health issues in Education →
   - Concepts, criteria and principles of Mental Health.
   - Mental hygiene-Objective, scope and Functions.

8. Memory, forgetting, Attention and Interest-
   - Memory and forgetting
   - Meaning and characteristics of Memory
   - The process of memorization, marks of a good memory and improvement of memory.
   - Forgetting-Meaning and Causes.
   - Attention and Interest→
     - ➢ Meaning & Characteristics of Attention, Types of Attention.
     - ➢ Meaning, sources and types of Interest, relation between attention and interest, educational significance of attention and interest.

9. Educational Statistics →
   - Concept and uses of Statistics in Education and Psychology
     - ➢ Statistical Method-Tabulation of data - Frequency distribution Table
     - ➢ Graphic representation of data-meaning, advantages and rules-Histogram and Polygon,
     - ➢ Diagram-Bar diagram and Pie Diagram.
     - ➢ Measures of Central Tendency-meaning and uses, Various measures of Central Tendency (Mean, Median and Mode)- their meaning, uses , merits and demerits, calculation of Mean, Median and Mode - from grouped and ungrouped data.
     - ➢ Measures of Variability-Meaning and Uses, Various measures of Variability, Range, quartile Deviation.

10. Advanced Philosophy of Education
    - Meaning, nature and scope of philosophy - Epistemology, Metaphysics and Axiology
    - Philosophy as determinant of aims, curriculum, method of teaching and teacher's role in education.
    - Vedic Philosophies – Samkhya,Vedanta and yoga.
    - Non-Vedic Philosophies-Chavaka, Buddhist and Jainism.
    - Islamic Educational thought

11. Comparative Education
    - Meaning and objectives of Elementary Education in different Countries. (USA, UK, Japan & India)
    - Structure, Administration & Finance,Curriculum, Method of Teaching
    - Advanced Sociology of Education,
    - Meaning, nature of social change and Factors
    - Meaning of Socialization

12. Educational Technology-Concept, Nature and Approaches of Educational Technology (Hardware, Software and systems Approach).

- Educational Technology as a Discipline-Information Technology, Communication Technology, Information and Communication Technology (ICT)
- Instructional Technology.
- Applications of Educational Technology in
- Formal education systems
- Non Formal Educational System.

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# SYLLABUS FOR ACCOUNTANCY (POST CODE: PGAC12026)

## 1. Financial Accounting

- Accounting – Concepts and Basic Terms
- Accounting Principles
- Journal and Ledger
- Accounting Equation
- Cash Book and Other Subsidiary Books
- Bank Reconciliation Statement
- Depreciation
- Trial Balance
- Financial Statement of Sole Proprietorship Firm
- Financial Statement of Partnership Firm
- Fundamentals of Partnership
- Valuation and Treatment of Goodwill
- Admission of a Partner
- Retirement and Death of a Partner
- Dissolution of Partnership Firm
- Accounts of Banking Companies
- Accounts of Life Insurance Companies
- Accounts of General Insurance Companies
- Investment Accounting
- Accounting for Hire Purchase System

## 2. Corporate Accounting

- Issue of Shares
- Forfeiture and Reissue of Shares
- Issue of Debentures

## 3. Cost Accounting

- Cost Sheet
- Accounting for Materials – FIFO and LIFO
- Accounting for Labour – Halsey and Rowan Plan
- Accounting for Overhead – Apportionment of Overhead
- Process Costing
- Reconciliation of Cost and Financial Accounting

## 4. Management Accounting

- Marginal Costing
- Budgetary Control
- Cash Flow Statement
- Fund Flow Statement
- Accounting Ratios
- Comparative and Common Size Statements

## 5. Tax

- Direct Tax
- Goods and Services Tax (GST)

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**SYLLABUS FOR BUSINESS STUDIES (POST CODE: PGBS12026)**

1. **Concept, Nature and Objectives of Business**
   - Definition and characteristics of business
   - Objectives: Economic and Social
   - Classification of business activities

2. **Public, Private and Global Enterprises**
   - Features of public and private sector enterprises
   - Forms of public enterprises: Departmental, Statutory Corporation, Government Company
   - Global enterprises – MNCs: features and role

3. **Forms of Business Organisation**
   - Sole Proprietorship, Partnership, Joint Hindu Family Business
   - Cooperative Societies and Joint Stock Companies
   - Comparative study of different forms

4. **Business Services & Principles of Insurance**
   - Banking, Transportation, Warehousing, Communication and Insurance
   - Principles of insurance: Utmost Good Faith, Insurable Interest, Indemnity, Contribution, Subrogation, Proximate Cause

5. **Emerging Modes of Business**
   - E-business – scope and benefits
   - Online transactions – buying/selling
   - Outsourcing – concept, need and scope

6. **Social Responsibility of Business and Business Ethics**
   - Concept of social responsibility
   - Business and environmental protection
   - Elements of business ethics

7. **Formation of a Joint Stock Company & Sources of Business Finance**
   - Steps in formation: Promotion, Incorporation, Subscription
   - Sources: Equity and preference shares, Debentures, Loans, Public deposits, Trade credit

8. **MSME and Business Enterprises**
   - Definition and classification of MSMEs
   - Role of MSMEs in Indian economy
   - Incentives and support from government

9. **Internal Trade & International Trade**
   - Types of internal trade: Wholesale, Retail
   - International trade: Export and Import – procedure and documents
   - Balance of Trade and Balance of Payments

10. **Concept, Nature & Levels of Management**
    - Definition, characteristics, importance
    - Levels: Top, Middle, Operational
    - Functions and roles of managers

11. **Principles of Management – General and Scientific**
    - Fayol’s principles of management
    - Taylor’s Scientific Management: Techniques and principles

12. **Business Environment**
    - Meaning and importance of business environment
    - Dimensions: Economic, Social, Technological, Political and Legal
    - Impact of government policy changes

13. **Managerial Planning – Concept, Importance and Process**
    - Types of plans: Strategic, Tactical, Operational
    - Steps in planning process
    - Limitations of planning

14. **Organising – Functional and Divisional Structure**
    - Meaning and importance of organising
    - Organisational structure – features, merits and limitations of functional and divisional structures
    - Formal and informal organisation

15. **Staffing – Concept, Process and Sources & Human Resource Management**
    - Staffing process – recruitment, selection, training and development
    - Sources of recruitment – internal and external
    - Concept and functions of HRM

16. **Directing – Communication, Supervision, Motivation, Leadership**
    - Elements and importance of directing
    - Types and barriers of communication
    - Motivation – Maslow's theory, financial and non-financial motivators
    - Leadership styles – autocratic, democratic, laissez-faire

17. **Controlling – Concept, Importance and Process**
    - Steps in controlling process
    - Relationship between planning and controlling
    - Tools of control

18. **Financial Management & Capital Budgeting Decision**
    - Objectives and functions of financial management
    - Capital budgeting techniques: Payback Period, NPV, IRR

19. **Theories of Dividend and Determinants of Dividend**
    - Walter’s model, Gordon’s model, MM hypothesis
    - Factors influencing dividend decisions

20. **Theories of Optimal Capital Structure & Determinants of Capital Structure**
    - Net Income Approach, Net Operating Income Approach, Modigliani and Miller Approach, Traditional Approach
    - Factors affecting capital structure

21. **Working Capital Management, Cash Management, Inventory Management**
    - Concepts of gross and net working capital
    - Determinants of working capital
    - Techniques of cash and inventory management

22. **Cost of Capital**
    - Cost of equity, debt, preference shares, retained earnings
    - Weighted Average Cost of Capital (WACC)

23. **Leverage – Operating, Financial and Composite**
    - Meaning and significance of leverage
    - Calculation and interpretation of Operating Leverage, Financial Leverage and Combined Leverage

24. **Marketing Management & Consumer Protection**
    - Marketing mix – 4Ps
    - Consumer rights and responsibilities
    - Consumer Protection Act and redressal forums

25. **Financial Market – Money Market and Capital Market**
    - Instruments of money market: treasury bills, commercial paper etc.
    - Capital market – primary and secondary market, stock exchanges

26. **Securities and Exchange Board of India, NSE and BSE, CDSL and NSDL**
    - Functions and roles of SEBI
    - Stock market indices, depositories and their functions

27. **Communication – Process, Objectives and Barriers, Listening**
    - Process of communication
    - Objectives and importance
    - Types and barriers of communication
    - Listening – active and empathetic listening

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**SYLLABUS FOR M.SC. (BOTANY) (POST CODE: PGBT12026)**

1. **Algae:** General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Reserved food; Pigments; Classification of algae; Morphology and life-cycles, Economic importance of algae
2. **Fungi:** Introduction- General characteristics, ecology, and significance, range of thallus organization, cell wall composition, nutrition, reproduction, and classification; True Fungi-General characteristics, ecology, and significance, life cycle
3. **Symbiotic Associations**-Lichens: General account, reproduction, and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance
4. **Bryophytes**: General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction, Ecology, and economic importance of bryophytes
5. **Pteridophytes**: General characteristics, Early land plants, Classification (up to family), morphology, anatomy and reproduction, Heterospory and seed habit, stellar evolution. ecological and economic importance of Pteridophytes. Life history of *Lycopodium, Selaginella & Isoetes,* Ferns
6. **Gymnosperms:**
   General characteristics, Classification (up to family), morphology, anatomy and Reproduction, Ecological and economic importance; distribution of Gymnosperms in NE India; Ginkgo, Pinus; Taxus, Gnetum
7. **Natural resources:** Definition and types. Natural resources of NE India. Renewable and non-renewable sources of energy.
8. **Sustainable utilization of land and water resources**: Soil degradation and management; water resources (Freshwater, marine, estuarine) wetlands; Threats and management strategies and their management.
9. **Biodiversity:** Definition, types, significance, threats, management strategies, CBD, Bioprospecting
10. **Contemporary practices in resource management**: EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management. National and international efforts in resource management and conservation.
11. **Sericulture:** Introduction: history and present status; Silk route. Sericulture industry in different states, employment, potential in mulberry and non-Mulberry sericulture. Entrepreneurship in sericulture:Identification of wild and domesticated silkworms
12. **Rearing of silkworms:** Mulberry silkworm rearing -Rearing house and rearing appliances, Early age and Lateage rearing. Types of mountages Spinning, harvesting and storage of cocoons. Non mulberry silkworm rearing: Host plants of nonmulberry silkworm, maintenance of host plants of *Antheraea assamensis*, rearing technology of *Antheraea spp* and *Samia cynthiaricini*
13. **Pests and diseases:** Pests of silkworm: Uzi fly, Apanteles, dermestid beetles and vertebrates. Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial. Symptoms, Control and prevention of pests and diseases.
    i)Sex separation in larva, pupa and adult of silkworm
    ii)Identification of different diseased silkworms based on external symptoms (Grasserie,Flacherie, Muscardine and Pebrine) and Identification of permanent slide of gut bacteria of silkworm, spores of Pebrine, spores of Muscardine
    iii) Rearing of eri silk worm on artificial diet

14. Significance of Plant Systematics: Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys:Single access and Multi-access.
15. **Taxonomic hierarchy:** Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).
16. **Botanical nomenclature**: Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.
17. **Systems of classification:** Major contributions of Theophrastus, Bauhin, Tournefort, Linaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification.
18. **Biometrics, numerical taxonomy and cladistics**: Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).
19. **Phylogeny of Angiosperms:** Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).
20. **Significance of Plant Systematics:** Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys:Single access and Multi-access.
21. **Taxonomic hierarchy:** Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).
22. **Botanical nomenclature** Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.
23. **Systems of classification: Major** contributions of Theophrastus, Bauhin, Tournefort, Linaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification.
24. **Biometrics, numerical taxonomy and cladistics: Characters**; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).
25. **Phylogeny of Angiosperms: Terms** and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).
26. **Biodiversity and its scope**- Genetic diversity, Species diversity, Plant and animal diversity at the ecosystem level. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle,
27. **Loss of Biodiversity:** Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Management of Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF,

NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation, Biodiversity awareness programs, Sustainable development.

Role of plants and animals in relation to Human Welfare; Importance of forestry and wildlife; their utilization and commercial aspects; Ornamental plants animals (fishes) and of NE India. Uses of microorganisms in human welfare (food, agriculture, medicine)

28. **Vermiculture** - definition, meaning, history, economic importance, value in the maintenance of soil structure, role as four r's of recycling (reduce, reuse, recycle and restore), Role in biotransformation of the residues generated by human activity and production of organic fertilizers, Useful species of earthworms, local and exotic species of earthworms
29. **Biology of certain important earthworms native to NE India**

    Taxonomy and reproduction of Lumbricidae. Vital cycle: alimentation, fecundity, annual reproducer potential; limit factors (gases, diet, humidity, temperature, PH, light, and climatic factors).
30. **Process of Vermicomposting**

    Small scale earthworm farming for home gardens - earthworm compost for home gardens Conventional commercial composting - earthworm composting larger scale (pit, brick and, heap systems) Earthworm farming, extraction (harvest), vermicomposting harvest and processing. Vermiwash collection, composition and use.

    Enemies of earthworms, sickness and worm's enemies; frequent problems – prevention and fixation.
31. **Applications of vermiculture**

    Benefits of vermicompost, Use of vermicompost in agriculture, Basic characteristics of earthworm suitable for vermicomposting, Problems in vermicomposting, vermicomposting of dairy waste.
32. **Overview of cell: Prokaryotic and Eukaryotic cells**

    Plasma Membrane and Cytoskeleton: Various models of plasma membrane structure, Transport across membranes: Active and Passive transport, Cell junctions: Tight junctions, Desmosomes, Gap junctions, Structure and Functions: Microtubules, Microfilaments and Intermediate filaments
33. **Endomembrane System: Structure and Functions:**

    Endoplasmic Reticulum, Golgi Apparatus, Lysosomes
34. **Mitochondria and Peroxisomes:**

    Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis, Peroxisomes
35. **Nucleus:** Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome).
36. **Cell Division and Cell Signalling**

    Mitosis, Meiosis, Cell cycle and its regulation, GPCR and Role of second messenger (cAMP).
37. **Introduction to Biochemistry**, scopes; chemical basis of life, functional groups; water as solvent, ionization of water, weak acids; pH, buffer solution; types of chemical bonds in biological systems and types of biomolecules (Macro and small molecules) and functions. Proteins: Classification and functions of proteins. Amino acids, properties, and functions. Peptide bonds and peptide groups; structural organization of protein- primary, secondary, tertiary, and quaternary. The structural and functional relationship of protein-

Ribonuclease-A, myoglobin, hemoglobin; protein denaturation and renaturation. Carbohydrates: Sources, and biological functions; Classification- monosaccharide, disaccharide, and polysaccharide. Classes and structure of mono and disaccharides, glycosidic bond: Stereoisomerism, mutarotation, anomer, epimer etc.; glycoproteins and glycolipids.

38. **Lipids:** Structure, classification, and biological functions of lipids; storage and membrane lipids, lipoprotein. Fatty acids: classification; saturated, unsaturated, polyunsaturated; essential and non-essential fatty acids.
39. **Molecular biology: Nucleic** acids: Types and functions of DNA, RNA; constituent monomers (nucleotides and nucleoside), DNA as genetic material, Structure of DNA and tRNA DNA replication: Chemistry of replication, DNA polymerases, synthesis of leading and lagging strands

    Prokaryotic transcription: RNA polymerase, promoters, sigma factors, initiation, elongation, and termination (Rho-dependent and independent), Eukaryotic transcription: types of RNA polymerases

    Translation: Translation in prokaryotes and eukaryotes: Ribosome, tRNA, amino-acyl tRNA synthetases, genetic code, translation-initiation, elongation, termination, and ribosome recycling. Regulation of gene expression in prokaryotes: Transcriptional regulation in bacteria: regulation of lac and trp operons in bacteria
40. **Recombinant DNA technology: Introduction** to biotechnology; Restriction Endonucleases (History, Types I-IV, biological role and application); Cloning Vectors; types
41. **Gene Cloning: Recombinant** DNA technology, Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning, DNA libraries, cDNA libraries, colony hybridization; Somatic cell nuclear transfer.
42. **Applications of Biotechnology: Pest** resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Gentically Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns.
43. **Animal cell culture: Historical** perspective; Composition of media; Nutrient and hormone requirements, maintenance of aseptic condition, types of cell lines, Application of cell culture, flow cytometry, MTT assay
44. **Plant Tissue Culture: Historical** perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, Cryopreservation; Germplasm Conservation).
45. **Ethnobiology:** Concept, history and theory; hypotheses, evolution and scope; Indigenous knowledge and traditional practices, ethnobiology of northeast India. Major ethnic groups in North East India; their social institutions, livelihood, cultural and religious practices, other belief systems, sacred groove. Methods of biological resource conservation & ecorestoration. Scope for development of plant resources.
46. **Traditional Knowledge**: Traditional knowledge system of different indigenous communities of North Eastern India. Application and practices of traditional knowledge system in agriculture, healthcare, livelihood and alternative food & fodder. Sustainable

utilization of biological resources and biodiversity conservation. Current status of Ethnobiology, biodiversity and traditional knowledge.

47. **Ethnobiology and Its Relevance in Contemporary Research:** Ethnobiology & drug discovery; Ayurvedic drug preparation and drug adulteration. Chemical composition of few medicinal and aromatic plants, extraction, and uses pertaining to typical Indian formulation of drugs. Ethnopharmacological validation of traditional medicine; approaches to drug discovery from ethnobotanical leads.
48. **Traditional Agronomic Practices:** Shifting cultivation, weeds and their management, beekeeping, Aquaculture
49. **Protection of Traditional Knowledge: Ethnobiology** & IPR; biopiracy, National Biodiversity protection initiatives; Convention on Biological Diversity, Nagoya protocol.
50. **Chromatographic methods:** Adsorption and partition principle. Thin layer chromatography (TLC), Paper (radial, ascending, descending), and column chromatography. Fundamentals of spectroscopic techniques: (a) UV-vis spectroscopy: Overview of spectroscopy techniques, Basic principles of electromagnetic radiation, Interaction of light with matter, Components of a UV-Vis spectrophotometer, Sample handling techniques, Beer-Lambert Law and its application in UV-Vis spectroscopy, Factors affecting absorbance spectra (solvent, pH, temperature, etc.), Applications of UV-Vis Spectroscopy in qualitative and quantitative analysis, in kinetic studies (monitoring reaction rates). (b) IR Spectroscopy: Introduction to IR Spectroscopy, Components of an IR spectrometer, Sample handling techniques, Vibrational modes of molecules, Theory behind IR spectra interpretation.
51. **Microscopy:** Concept of Resolution and Magnification, Optical Microscopy- Bright Field Microscopy, Dark Field Microscopy, Phase Contrast Microscopy, Fluorescence Microscopy and Electron Microscopy. Centrifugation technique- Principle of centrifugation, Differential and Density gradient centrifugation (Rate Zonal Centrifugation, Isopycnic Centrifugation). Concept of DNA structure, PCR-based DNA amplification: PCR chemicals and principle of PCR. Electrophoretic separation of biomolecules-principle; Blotting techniques—Southern, Northern, and Western.

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# SYLLABUS FOR COMPUTER SCIENCE (POST CODE: PGCS12026)

1. **Fundamentals of Computer**
   - Introduction, History, Generation, Evolution, Information Technology (IT)
   - Storage and Display Technologies
   - Types of Computers
   - Hardware/Software Concepts – Input/Output Devices, CPU, Memory
   - Microprocessor Basics
2. **Software Concepts**
   - Types of Software – System Software, Application Software
   - Open Source Concepts
   - Operating System Functions – Processor, Storage, and Information Management
   - Examples of Operating Systems
3. **Web Basics**
   - HTML and CSS
4. **Getting Started with Programming and Problem Solving**
   - Introduction to C and C++ Programming Languages
5. **Data Representation and Discrete Mathematics**
   - Digital Number Systems and Conversions
   - Basic Knowledge of ASCII and ISCII
   - Boolean Algebra including K-Map Concepts
   - Set Theory
6. **Object-Oriented Programming (OOP)**
   - Basic Concepts – Class and Objects, Constructor and Destructor
   - Visibility Modes and Inheritance
7. **Data Structure**
   - Array, Stack, Queue, Pointer, Structure
8. **Database Management System and SQL**
   - Database Concepts and Relational Databases
   - Relational Algebra – Selection, Projection, Union, Intersection, Set Difference, Cartesian Product
9. **Networking**
   - ARPANET, Internet
   - Circuit and Packet Switching
   - Data Transfer Rates
   - Transmission Media – Twisted Pair Cable, Coaxial Cable, Optical Fibre
   - Network Devices, Network Topologies and Types
   - Network Protocols
10. **Network Security**
    - Threats and Protection from Viruses
    - Use of Cookies, Firewalls
    - Cyber Law and Cyber Crime
    - Cryptography and Hacking
11. **Artificial Intelligence**
    - Basic Knowledge in AI and Machine Learning

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**SYLLABUS: DIPLOMA IN MECHANICAL ENGINEERING (POST CODE: INTRM12026)**

1. Importance of safety and precautions, housekeeping & good shop floor practices. PPEs, First Aid. Response to emergencies e.g. power failure, fire, and system failure. Occupational Safety & Health.
2. Computer Architecture, Number System and codes, Introduction to Operating System, Computer Network and the Internet, Introduction to C programming.
3. Nature and scope of environmental problems, definition, Elements of Ecology, Environmental Pollution, Environmental Sanitation, Resource Conservation
4. Fluid Mechanics & Fluid Machines: Physical Properties of Fluids, Fluid Statics, Fluid Kinematics, Fluid Measurements, Pipe & Open Channel Flow, Fluid Machines, Hydraulic Turbines, Pumps.
5. Electrical & Electronics Engineering: DC network, Generator & motor, AC fundamental, AC circuit, Transformer, Semiconductor, Transistor, House Wiring, Microprocessor.
6. Manufacturing Technology – I: Basic of Machine Tools, Metal Casting Process, Welding Processes, Press Work, Powder Metallurgy, Cutting Fluids and Coolants.
7. Thermodynamics: Fundamentals and laws of Thermodynamics, Laws of perfect gases, Thermodynamic processes on gases, Fuels and Combustion, Air standard cycles, Properties of steam, Vapour Power cycle, Heat Transfer.
8. Engineering Materials: Mechanical Properties of Materials, Structure of Solids, Ferrous Metals and its Alloys, Non- Ferrous Metals and Its Alloys, Plastic, Testing of Materials, Heat Treatment, Corrosion & Surface Engineering.
9. Manufacturing Technology-II: Lathe, Drilling machine, Shaper, Planer & Slotter, Grinding & Surface finishing, Milling machine, Non-Traditional machining methods, Jigs and Fixtures.
10. Theory of Machines: Definition of Theory of Machine (TOM), Basic kinematics of Machines, Friction, Transmission of Power, Cams, Balancing, Mechanical Vibrations, Governors.
11. Strength of Materials: Simple Stresses and strains, Shear force and bending moments, Theory of simple bending and Deflection of beam, Stresses in beams, Torsion in circular shafts and springs, Columns and Struts, Rivets and riveted joints.
12. Machine Drawing: Cutting geometric Solids with planes, Keys, Cotters Joints and Pin Joints, Pipes Drawings, Welded Joints, Shaft Coupling, Shaft Bearing and Brackets, Pulleys, Valves, Engine Parts, AutoCAD.
13. Thermal Engineering-I: Steam generators, Steam nozzles, Steam turbine, Steam condensers and Cooling towers, Nuclear power plant, Heat transfer:
14. Industrial Engineering: Work study, Job Evaluation & Merit Rating, Wage Systems, Inspection and Statistical quality control, Network Analysis.
15. Plant Maintenance Engineering: Introduction of maintenance engineering, Power Plant maintenance, Preventive maintenance, Electrical maintenance.
16. Advance Workshop Practice& CNC Machine: Introduction of the Shop Floor: Safety and security measures inside the Tool Room, Fundamentals of Cam, Manual Part Programming
17. Non-Conventional Energy: Introduction to Non-Conventional Energy Sources, Solar Energy Engineering, Wind Energy Engineering, Ocean Energy Engineering, Geothermal Energy Engineering, Bio Energy Engineering, Direct Energy Conversion Systems, Chemical Energy Sources
18. Thermal Engineering-II: Internal Combustion Engine, Air compressors, Gas turbine and propulsion, Refrigeration Cycle
19. Drawing, Estimating & Costing: Jigs and Fixtures, Introduction to Estimation and costing, Elements of costs, Indirect expenses and depreciation, Mensuration and Estimation of material cost, Estimation of Machining Time, Estimation of Welding & Fabrication Time Sheet metal
20. Metrology: Metrology concepts and standards, Basic Precise and Non Precise Measuring instruments, Limits, Fits, Tolerances and Gauges, Angular Measurements, Comparators, Screw Thread Measurement, Gear Measurement, Surface Finish Measurement, Machine tool metrology.

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**SYLLABUS-DIPLOMA IN CHEMICAL ENGINEERING (POST CODE: INTRC12026)**

1. Importance of safety and precautions, housekeeping & good shop floor practices. PPEs, First Aid. Response to emergencies e.g. power failure, fire, and system failure. Occupational Safety & Health.
2. Computer Architecture, Number System and codes, Introduction to Operating System, Computer Network and the Internet, Introduction to C programming.
3. Nature and scope of environmental problems, definition, Elements of Ecology, Environmental Pollution, Environmental Sanitation, Resource Conservation
4. Electrical & Electronics Engineering: DC network, Generator & motor, AC fundamental, AC circuit, Transformer, Semiconductor, Transistor, House Wiring, Microprocessor.
5. Element of Mechanical Engineering: Introduction, Properties and laws of gases, Properties of steam, Generation of steam, Steam engine, Internal combustion engine, Steam Turbines, Gas Turbines, Transmission of motion and power:
6. Principles of unit operation-I: Flow of fluid, Transportation of fluid, Fluid flow measuring instruments, Heat Transfer.
7. Applied Chemistry: Thermodynamics, Chemical Kinetics, Ionic Equilibrium, Colloidal Chemistry, Organic Chemistry.
8. Industrial Chemical Process-I: Definition of Unit Process and Unit Operation with examples of each, Water (Industrial & Municipal) Supply, Acid Industry, Alkali – Industry.
9. Fuels, Furnace and Refractories: Fuels, Solid Fuel, Liquid fuel, Gaseous Fuel, Renewable Energy, Furnace, Refractories.
10. Stoichiometry, Thermodynamics & Kinetics.
11. Principles of unit operation -II: Distillation, Absorption, Leaching and Extraction, Drying.
12. Instrumentation: Basic principles of Measurement, Sensing Elements, Transducers, Indicating and Recording means, Temperature Measurement, Pressure Measurement, Liquid level measurement, Flow Measurement, Special methods of Measurement.
13. Industrial Chemical Process-II: Soap and detergent, Plastics, Hydrogenation of Fats and Oils, Adhesive, Cement.
14. Petrochemicals: Types, Process of manufacturing of Petrochemicals, Synthetic detergents, Insecticides, Manufacture of Petrochemicals, Monomers, Plastics and Resins, Rubber, Varnish, Fibres.
15. Principles of unit operation -III: Evaporation, Crystallization, Filtration, Adsorption, Sedimentation and Settling.
16. Fertilizer Technology: Introduction, Production of Ammonia, Sulphuric Acid, Urea, Ammonium Sulphate, Nitric Acid, Ammonium Nitrate.
17. Petroleum Technology: Nature of Petroleum, Concepts of Petroleum geology and basic rock properties, Petroleum Exploration Methods, Drilling Methods. Well Logging, Oil well cementing and casing practices, Well Completion, Reservoir Studies.
18. Automatic Process Control: Science of Automatic Control, Controlling Elements, Transmission System, Final Control Elements, Application of Control Engineering, Distributed Digital Control System:
19. Industrial Chemical Process III: Pulp & paper, Fertilizer, Lime, Cement, Sugar, Leather, Glass, Adhesive.
20. Principle Of Unit Operation – (IV): Size reduction, Mechanical Separation, Mixing, Conveying.

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**SYLLABUS - DIPLOMA IN PETROLEUM ENGINEERING (POST CODE: INTRP12026)**

1. **Mathematics**

Algebra: Equations, inequalities, matrices & determinants
Trigonometry: Identities, inverse trig functions, solutions of triangles
Calculus: Limits, continuity, differentiation, applications
Coordinate Geometry: Straight lines, conic sections
Introduction to statistics & probability basics
Advanced differentiation & integration
Differential equations (first & second order)
Vector calculus basics
Complex numbers
Probability & statistics applications in engineering
Numerical methods (roots, interpolation, integration)
Laplace transforms & applications
Fourier series basics
Partial differential equations in engineering contexts

2. **Physics**

Units & dimensions, vector analysis
Kinematics, Newton's laws, work, energy, power
Rotational motion, moment of inertia
Oscillations & waves, simple harmonic motion
Basics of thermodynamics & heat transfer
Fluid statics & dynamics
Sound & acoustics
Light: reflection, refraction, optical instruments
Electricity & magnetism basics
Modern physics: quantum concepts
Heat & thermodynamics
Properties of fluids
Electricity & magnetism advanced concepts
Introduction to semiconductor devices

3. **Chemistry**

Atomic structure & periodic table
Chemical bonding & molecular structure
States of matter: gases, liquids, solids
Stoichiometry & chemical equations
Acids, bases, salts & pH
Hydrocarbons & petroleum chemistry basics
Organic reaction mechanisms
Industrial water treatment
Corrosion & prevention
Lubricants & additives
Petroleum hydrocarbon classification
Distillation & separation chemistry
Catalysts in petroleum processing
Analytical techniques: chromatography, spectroscopy

4. **Introduction to Petroleum Engineering**

Overview of oil & gas industry
History & global importance of petroleum
Types of petroleum reservoirs
Exploration to production cycle
Role of petroleum engineers

5. **Engineering Drawing**

Drawing instruments & standards (IS codes)
Orthographic projection
Isometric & oblique views

Sectional views & dimensioning
Introduction to CAD

**6. Electrical & Instrumentation Engineering**

Basic electrical quantities & Ohm's law
AC/DC circuits, transformers, motors
Electrical safety & earthing
Introduction to measurement instruments
Sensors & control systems in petroleum

**7. English/Communication Skills**

Grammar & vocabulary building
Business correspondence basics
Oral communication & presentations
Technical report writing basics

**8. Basics of Geological Science**

Earth structure & plate tectonics
Types of rocks & minerals
Sedimentary basins & petroleum system elements
Geological mapping & cross-sections
Geophysical exploration basics

**9. Fundamentals of Mechanical Engineering**

Simple machines & power transmission
Basics of thermodynamics
Properties of engineering materials
Pumps, compressors, turbines basics
Introduction to maintenance practices

**10. Fundamentals of Computer Engineering**

Computer hardware & software basics
Operating systems & networking
MS Office & technical documentation
Basics of programming logic (C/Python)
Petroleum engineering software introduction

**11. Drilling Technology: Equipment & Operations**

Rotary drilling principles
Rig types & components (derrick, hoisting, rotary, circulation systems)
Drilling bits: types, selection, wear
Drilling fluids: properties, maintenance
Casing & cementing basics

**12. Reservoir Engineering**

Rock properties: porosity, permeability, compressibility
Fluid properties: oil, gas, water PVT behavior
Darcy's law & multiphase flow basics
Drive mechanisms (solution gas, water, gas cap)
Material balance concepts

**13. Fundamentals of Fluid Mechanics**

Fluid properties & measurement
Fluid statics & manometry
Flow through pipes & fittings
Pumps & fluid machinery basics

**14. Heat & Mass Transfer**

Modes of heat transfer: conduction, convection, radiation
Heat exchangers: types & design basics
Mass transfer principles: diffusion, Fick's law
Separation processes (absorption, distillation)

**15. Petroleum Production Operations I**

Production systems overview
Well completion methods
Natural flow vs. artificial lift systems
Wellhead equipment & Christmas tree
Production logging tools

**16. Well Logging: Instrumentation & Operations**

Wireline logging principles

SP, resistivity, gamma ray logs
Density, neutron, sonic logs
Interpretation basics for lithology & fluid identification

**17. Pumps & Compressors: Operations & Maintenance**

Reciprocating & centrifugal pumps
Gas compressors: reciprocating, centrifugal, screw
Maintenance practices & troubleshooting
Lubrication systems

**18. Petroleum Refining & Product Testing**

Crude oil classification
Refinery flow schemes
Distillation (atmospheric & vacuum)
Conversion processes: cracking, reforming, alkylation
Product testing methods: ASTM standards

**19. Humanities & Social Sciences**

Industrial sociology & organizational behavior
Professional ethics in engineering
Workplace safety culture
Soft skills for petroleum sector

**20. Drilling Operations & Well Completion**

Directional & horizontal drilling
Managed pressure drilling
Advanced casing & cementing
Well completion design for various reservoir types
Workover operations

**21. Petroleum Production Operations II**

Artificial lift systems in detail (ESP, PCP, gas lift, rod pump)
Surface production facilities
Flow assurance & hydrate prevention
Sand control techniques
Enhanced production methods

**22. Petroleum Economics & Energy Management**

Oil & gas project economics
Cost estimation & budgeting
Economic indicators: NPV, IRR, payback period
Energy policy & sustainability
Contracts & PSC models

**23. Health, Safety & Environment in Petroleum Industry**

Hazard identification & risk assessment
Offshore & onshore safety systems
Oil spill prevention & response
Environmental impact assessment
Regulatory frameworks (OSHA, OISD, API standards)

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