

Common Courses for Dual degree programmes

Humanities and Social Sciences

History and Society: What is history; sources of history; historical methods; evolution of society; folk culture, a historical society Society and Culture: Different types of Society; Meaning of Social Structure; Social institutions and their role in the society; Elements of Culture, Difference between culture and civilization; Social values, Norms ,Tradition and custom; Village community, Tribal community; social Stratification- caste, class systems Social Change and Development: Concept of change, evolution, social process and development; theory of development; social justice and development; Environmental issues and sustainable development, modernization and globalization.Economy and Society: Traditional and modern economy; exchange system; Agrarian and industrial society; urbanization and its impacts on society Polity and Society: Different political system; role of state; forms of government; democracy; socialism and Communism, Idea of republic; concept of nation and state Post-colonial Society: Feature of post-colonial society; different paths of development; issues and challenges.

Text/ Reference Books:

- E. H.Karr, What is History?
- Giddens, A (2009), Sociology, Polity, 6th edn
- Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan
- Oommen,T.K.(ed.) (1997), Citizenship and National Identity: From Colonialism to Globalization, Sage
- Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan
- Rao, M.S.A. (ed.) (1974), Urban Sociology, Orient Longmans

Environmental Studies

Concepts of Matter and Energy; Planet Earth-Basic Facts: Basics of Solar System, Characteristics of Solar Energy received by the Earth Structural Features of the Earth: Lithosphere, Glaciers, Hydrosphere, Atmosphere, Biosphere Natural Resources: Basis of Biogeochemical cycles, Air/Water/Land Ecology: Ecosystem, Types of Ecosystem, Foodweb/Energy and Material Flow, Forests/Plants/Biological Diversity, Hot-spots of Biodiversity, Threats to Biodiversity (Habitat loss, poaching of wildlife, Man-made conflicts) Impact of human activities on environment: Concept of EIA, Concept of sustainable development, Case studies, Wasteland Reclamation, Consumerism and waste products, Environment Protection act, Issues involved in enforcement of environmental legislation, Air (Prevention and control of pollution act), Water (Prevention and control of pollution act), Wildlife Protection Act, Forest Conservation Act, Public awareness, Rain water harvesting; Environmental Pollution and remedial measures: Concepts and reasons underlying pollution, Water pollution, Soil pollution, Marine pollution, Air pollution, Role of individuals in prevention of pollution, Pollution case studies, Noise pollution, Thermal Pollution, Nuclear Pollution, Solid waste management (causes, effects and control measures of urban and industrial wastes); Contemporary environmental issues: Disaster management (floods, earthquakes, cyclones and landslides), Global warming, Ozone layer depletion, Acid rain, Deforestation; Environmental standards and role of institutions: MOEF/CPCB/SPBs, Laws to protect environmental quality, Importance of environmental education

Text/ Reference Books:

- Gilbert M. Masters, Introduction to Environmental Engineering and Science,
- Saumitra Mukherjee, Text Book of Environmental Remote Sensing
- Eugene P. Odum, Gary W. Barrett, Fundamental of Ecology
- A.K. De, Environmental Chemistry,
- Press and Siever, Understanding Earth
- Tom Garrison, Essentials of Oceanography

Engineering Mathematics-I (Calculus and Transform)

Review of limits, continuity, differentiability, Mean value theorem, Taylors Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume. Partial Derivatives, gradient and directional derivatives, chain rule, maxima and minima, Lagrange's method of undetermined multipliers. Double and Triple integration, Jacobians and change of variables formula. Parametrization of curves and surfaces, vector Fields, line and surface integrals. Divergence and curl, Gauss Theorem, and Stokes Theorem. The Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Generalization of Parseval's Theorem. The z- Transform for discrete time signals and systems- eigen functions, region of convergence, system functions, poles and zeros of systems and sequences, z-domain analysis. Generalization of Parseval's Theorem.

Text/ Reference Books:

- H. Hallett et al., Calculus - Single and Multivariable, John-Wiley and Sons, 2003.
- J. Stewart, Calculus, Thomson, 2003.
- T. M. Apostol, Calculus, Volumes 1 and 2, Wiley Eastern 1980.
- G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, ISE Reprint, Addison-Wesley, 1998.
- Erwin Kreyszig, Advanced Engineering Mathematics, Wiley

Engineering Foundation (Computer Programming)

Stored program concept (with simple computer simulator), machine language and instruction formats, assembly language for the simple computer. Characteristics of Computers, Evolution of Computing, Binary Number Systems, Types of Computer Software, Operating Systems, Programming Languages, Problem Solving Techniques using Computers: Algorithm, Flow Charts, Pseudocode. Introduction to Computer Networks, Internet, World Wide Web, Getting Connected to Internet. Problem Solving, Concept of Algorithms, Introduction to Computer Programming, Editing and Compiling a Program.

Text/ Reference Books:

- V. Rajaraman, N. Adabala, Fundamentals of Computers, PHI, 2014
- P. Pannu, Y. A. Tomer, ICT4D Information Communication Technology for Development, I K International Publishing House Pvt. Ltd, 2010.

- S.K.Basandra, Computer Today, Galgotia Publications, 2009

Engineering Drawing & Visualization

Sketching of engineering objects and interpretation of drawings as a visualisation and communication tool. Creating 3D components through the use of a CAD package. Simple assemblies, generation of assembly views from part drawings, animation of simple assemblies.

Text/ Reference Books:

- Bhatt N.D. and Panchal V.M., "*Engineering Drawing*", Charotar Publishing House, 50th Edition, 2010.
- Sikka V.B, A course in Civil Engineering Drawing, S.K. Kataria & Sons publication, 1997.
- B. Agrawal, C M Agrawal "*Engineering drawing*", Tata McGraw Hill Education Private Limited.

Principles of Economics

Definition of economics, subject matter, scope and nature of economics, Microeconomics vs. Macroeconomics, Normative vs. Positive Economics, Stock vs. Flow variables; consumer behavior and demand. Consumer pText Books. Indifference curve. Consumer equilibrium. Demand function. Income and substitution effects. The Slutsky equation. Market demand. Elasticities. Average and marginal revenue. Revealed preference theory of firm. Theory of production. Production functions. Laws of returns to scale. Isoquants. Input substitution. Equilibrium of the firm. Expansion path. Cost function. Theory of costs. Short Run and Long run costs. Economies and diseconomies of scale. Market equilibrium under perfect competition. Aggregate demand and supply. Equilibrium under alternative forms of market. Monopoly: pure and discriminating. Monopolistic competition. Oligopoly.

Text/ Reference Books:

- N. G. Mankiw, Principles of Economics, South-Western College Publishing, 2014.
- P. A. Samuelson, and W. D. Nordhaus, Economics, McGraw Hill Education, 2010.
- H. R. Varian, Intermediate Microeconomics, W. W. Norton & Company, 2003.
- A. S. Guha, Economics with-out Tears: A New Approach to an Old Discipline, Penguin
- Random House India, 2016.

English in Practice

Grammar in Use: Parts of Speech, Agreement of Subject and Verb, Articles, Prepositions, Tenses, Voice (Active/Passive), Conditional Clauses, Use of connectives in Complex and Compound sentences, Direct and Indirect Speech, Question tags and short responses, Collocations, Common Errors in English Language Phonetics/ Vocabulary Building: Basic introduction to Phonetics (IPA Symbols, Vowels and Consonants, Place and Manner of Articulations), Basic transcription, Syllables and Stress pattern in English, Accentuation and Pronunciation, Speech mechanism & Spoken exercises, Group discussion & Public speaking,

Basic introduction to Group presentation, Concept of word formation and technical Vocabulary, Etymology - Root words from foreign languages and their use in scientific terminology, Prefixes and suffixes to form derivatives used in science and technology, Synonyms/ Homophones/ Homonyms/ Homographs / One word substitution, Proper Usage of a Dictionary (Spelling/ Meaning / Pronunciation & correct usage of the word) Reading Skills: Effective reading strategies, Skimming a text vs. Scanning a book for specific details, Effective Reading techniques, Note taking for literature reviews and term papers, Comprehension of Unseen Passage – literary works (poems/ short story/ novel) and a scientific article, Note Making, Interpretation of Non Verbal Data Writing Skills: Function of sentence structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Common Errors in writing, Organizing principles of paragraphs and documents, Techniques for writing precisely, Summarizing and Paraphrasing techniques

Text/ Reference Books:

- M.Swan, Practical English Usage, Oxford, 2013.
- R. Murphy, Intermediate English Grammar, Cambridge University Press, 1999.
- M. Hewings, Advanced English Grammar, Cambridge University Press, 1999.
- M. McCarthy, F. O'Dell, Academic Vocabulary (50 units of academic vocabulary reference and practice Self-study and classroom use), Cambridge University Press, 2008.

Physics-I

Electrostatics: Gradient, divergence, curl, Gauss divergence theorem, Stoke's theorem, Gauss's law of electrostatics, Relationship between Electric Field & Potential. Electromagnetics: Maxwell's electromagnetic wave equations, magnetic Induction, Ampere's circuital law, Faraday's law of electromagnetic induction, Dielectrics, Types of polarization, Poynting theorem, Electromagnetic Spectrum, Equation of continuity, EM Wave equation and its propagation characteristics. Quantum Mechanics & Statistical Physics: De-Broglie Hypothesis, Davisson Germer experiment, wave function and its properties, Wave Packet, Uncertainty principle. Schrodinger Equation for free Particle, Time Dependent Schrodinger Equation, Particle in a box, Single step Barrier, Tunnelling effect, Maxwell Boltzman, Bose-Einstein and Fermi-Dirac statistics distribution, functions & their comparison.

Text/ Reference Books:

- D J Griffith, Introduction to Electrodynamics, Pearson, 2014
- Jordan & Balmain, Electromagnetic waves and Radiating Systems, Pearson, 2015
- Purcell, Electricity and Magnetism, Berkeley Physics Course, McGraw-Hill, 1984

Chemistry-I

Schrodinger equation; interpretation of wave function; hydrogen atom; atomic and molecular orbitals. Structure, bonding and energy levels in molecules and solids. Intermolecular forces. Chemical Potential; fugacities activities and equilibrium constants; Relation between G and emf; Standard potentials; Chemical Kinetics: steady state approximation; Collision theory. Trends in the periodic table; metallurgy; basic principles and applications; purification of elements and metals; transition metal ions and complexes; coordination chemistry,

magnetochemistry, role of metal ions in biological processes; some relevant uses of transition elements; catalysis; semiconducting and super conducting materials; zeolites; VSEPR; spinel. Conformations of alkanes and cycloalkanes; configurations, molecular chirality, geometrical isomerism. Linear and cyclic conjugation, benzene, aromaticity, properties of conjugated systems. Reactivity, reaction types, reaction mechanisms, reaction energetics and kinetics. Study of selected reactions and their mechanisms; nucleophilic substitution reaction, electrophilic and free radical addition reactions, electrophilic aromatic substitutions, nucleophilic addition; principles of nucleophilic addition to carbonyl groups. Molecular systems of technological and biological importance.

Text/ Reference Books:

- P. W. Atkins, Physical Chemistry, ELBS/Oxford, 7th Edition, 1995.
- B.H. Mahan and R. J. Myers, University Chemistry, 4th edition, Benjamin, California, 1987.
- D. A. McQuarrie and J.D. Simon, Physical Chemistry - a molecular approach, Viva Books Pvt. Ltd. (1998).
- R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th edition, 1990.
- M. J. Sienko and R. A. Plane, Chemical Principles and Applications, McGraw Hill, 1980.
- J. D. Lee, Concise Inorganic Chemistry, 4th Edition, ELBS, 1991.
- D. D. Ebbing, General Chemistry, Houghton Mifflin Co., 1984.

Engineering Mathematics –II (Probability and Statistics)

Probability definition, conditional probability, Bayes theorem, random variables, expectation and variance, specific discrete and continuous distributions, e.g. uniform, Binomial, Poisson, geometric, Pascal, hypergeometric, exponential, normal, gamma, beta, moment generating function, Poisson process, Chebyshev's inequality, bivariate and multivariate distributions, joint, marginal and conditional distributions, order statistics, law of large numbers, central limit theorem, sampling distributions - Chi-sq, Student's t, F, theory of estimation, maximum likelihood test, testing of hypothesis, nonparametric analysis, test of goodness of fit.

Text/ Reference Books:

- S. M. Ross, "Probability Models", 8th Edition, Academic Press, 2003
- K. S. Trivedi, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", 2nd Edition, Wiley, 2004

Engineering Foundation (Thermodynamics)

Introductory Concepts of Thermodynamic Systems and variables, Work, Heat, Internal Energy, Thermodynamic Equilibrium, Reversible and Irreversible Processes; Phase Rule; Significance of Chemical Engineering Thermodynamics; Equations of State and Generalized Correlations for Prediction of Volumetric Properties of Fluids; First Law: Closed and Open Systems, Steady and Transient Flow Processes; Second law and Entropy; Entropy Balance and Availability, Isentropic Efficiency; Maxwell Relations and Fluid Properties Estimation, Application to Flow Processes; Single Phase Mixtures and Solutions; Ideal Solutions; Partial