Unit 1


**Chemistry of corrosion and its control:** Chemical and electro chemical corrosion – Pilling Bed worth ratio – forms of corrosion.

Unit 3

**Electrochemical series - galvanic series - corrosion potential – corrosion current – rate of corrosion – units of corrosion - rate determination – weight loss method.**

**Corrosion control - cathodic and anodic protection.**


**TEXTBOOKS:**
Schools of Engineering  Amrita Vishwa Vidyapeetham  S 3

Catalysis through enzyme, organic catalysis, metalloenzyme catalysis, supported enzymes. Industrial applications of enzyme catalyst.

**Catalysis by Polymers:** Attachment of catalytic groups to polymer supports. Adsorption and the Kinetics of polymer-catalyzed reactions.

**Unit 3**
Catalysis in polymer gels, bifunctional and multifunctional catalysis, porous polymers. Applications of polymer catalysis.

**Catalysis in Molecular scale cavities:** Structures of crystalline solids, structure of Zeolites, catalysis by Zeolites, catalysis by Zeolites containing metal complexes and clusters. Catalysis on surfaces – surface catalysis, catalysis on metal surfaces.

**TEXTBOOKS:**

**REFERENCES:**

**CHY251 CHEMISTRY OF ENGINEERING MATERIALS 3 0 0 3**

**Unit 1**
**Chemical materials in Electronics and Electrical Engineering:** Structural correlation to behavior of conducting polymers, Semi-conducting polymers - properties of organic polymers containing metal groups such as poly ferrocene - optical fibers - definition, principle and structure - characteristics of optical fibre - photo resist optical fibre - advantages of optical fibre - liquid crystalline - peizo and pyroelectric polymers - magnetic materials, hard and soft magnets – sensors (voltametric).

**Nanomaterials:** Nanotubes and Nanowires, Carbon nanotubes, single walled and multiwalled, aligned carbon nanotubes, doping with boron – applications - Nanostructured polymers.

**Unit 2**

**Chemistry of Engineering Plastics:** Preparation, properties and applications of ABS, polycarbonates, epoxy resins - polyamides - Nylon and Kevlar.

**Photochemistry in Electronics:** Photochemical reactions - laws of absorption

**Unit 3**
Florescence and Phosphorescence - chemiluminescence - photo sensitization.

**Chemistry of Toxic Materials and Toxicology:** Principles of Toxicology - Volatile poisons - Gases CO, hydrocyanic acid - H₂S - PH₃ - CO₂ - SO₂ - NOₓ - Heavy metals - lead, arsenic, mercury, antimony, barium, bismuth, selenium, zinc, thallium - Pesticides - Food poisoning - Drug poisoning - barbiturates - narcotics - ergot - LSD - alkaloids - Radioactive Toxicology - Radiation hazards.

**TEXTBOOK:**

**REFERENCE:**

**CHY252 CHEMISTRY OF ADVANCED MATERIALS 3 0 0 3**

**Unit 1**
**Chemistry of Engineering Plastics:** Preparation, properties and applications of ABS, polycarbonates, epoxy resins - polyamides - Nylon and Kevlar.

**Chemistry of Carbon nanotubes:** Introduction, carbon nanotubes - fabrication, structure, electrical properties - vibrational properties - mechanical properties - applications of carbon nanotubes.

**Unit 2**

**Unit 3**
**Functional electro active polymers:** Conjugated polymers - synthesis, processing and doping of conjugated polymers: polyacetylene, polyaniline, polythiophene, poly (p-phenylenevinylene) - ionically conducting polymers - applications of conjugated polymers. Semi-conducting, poly ferrocene - photo resist
optical fibers and sensors, photo chrome & thermo chromic materials.

**Photochemistry in Electronics:** Laws of absorption - quantum efficiency and quantum yield - fluorescence and phosphorescence – photosensitization.

**High energy materials:** Preparation, properties and application of ammonium nitrate (AN), NH$_4$NO$_3$, ammonium perchlorate (AP), NH$_4$ClO$_4$, ammonium dinitramide (AND), NH$_4$N(NO$_2$)$_2$, hydrazinium nitroformate (HNF), NH$_4$C(NO$_2$)$_3$ etc.

**TEXTBOOKS:**

**REFERENCES:**

CHY253 ADVANCED POLYMER CHEMISTRY 3 0 0 3


Unit 2 Solid-state irradiation polymerization - Atom transfer radical polymerization - Plasma Polymerization - Zwitterionic Polymerization - Isomerization polymerization - Polymer supported solid phase reactions - Merrifield method.

**Polymer degradation and stabilization:** Mechanism of different types of degradation - Commonly used antidegradants and the mechanism of their stabilization.


**TEXTBOOK:**

**REFERENCE:**
CHY255  CHEMISTRY OF TOXICOLOGY  3 0 0 3

Unit 1
Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of Toxicants - broad overview of toxicant classes such as metals, agricultural chemicals, food additives - contaminants, toxins, solvents, drugs, and cosmetics - history, exposure route, and toxicity of the non-essential metals - cadmium, lead, and mercury - medical treatment of metal poisoning - classes of agricultural chemicals - Toxins - source, including microbial, fungal, algal, plant and animal - examples - Brief discussions - food additives and contaminants - solvents - therapeutic drugs - drugs of abuse - combustion products - cosmetics.

Unit 2
Exposure Classes, Toxicants in Air, Water, Soil, Domestic and Settings:
Occupational Air, water and soil as primary media for human exposure to various classes of chemical toxicants in environmental, domestic, and occupational settings - historic and present status of air pollution and air quality - introduction to the major classes of soil and water pollutants - sources, exposure routes and potential adverse health effects - Classes of occupational toxicants - route of exposure and permissible levels - specific examples of concern.

Unit 3
Toxicant Analysis and Quality Assurance Principles:
Introduction to procedures, principles and operation of analytical laboratories in toxicology. Summary of the general policies - analytical laboratory operation, analytical measurement systems, quality assurance (QA) - quality control (QC) procedures.

Environmental Risk Assessment:
Environmental risk assessment procedures - particular environmental risk problem - appropriate endpoints - development of conceptual models, analyzing exposure - effects, information - characterizing exposure - ecological effects - management of risks.

Future Considerations for Environmental and Human Health:

TEXTBOOK:

REFERENCES:

CHY256  CHEMISTRY OF NANOMATERIALS  3 0 0 3

Unit 1
Introduction: Introduction to Nanomaterials: Size dependence of properties - Surface to volume ratio and Quantum confinement. Microscopic techniques to study nano structures - SEM, AFM - TEM and STM - Raman spectroscopy.

Synthesis of Nanomaterials:
Synthetic approaches: Colloidal Self-Assembly (Self-assembled monolayers - SAMs) and electrostatic self-assembly, electrochemical methods, sol-gel deposition

Unit 2
Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling.
Carbon nanostructures: Carbon Clusters: Fullerenes, structure, synthesis, alkali doped C_60 - superconductivity in C_60, applications of fullerenes. Carbon nanotubes: Classification, properties, synthesis, characterization, and potential applications, growth mechanism of carbon nanotubes.
Other Nanostructures: Quantum Dots: Preparation, properties and applications of Au, CdS and CdSe quantum dots.

Unit 3
Fabrication and applications of conducting polymer nanotubes, TiO_2 and metallic nanotubes.
Molecular Electronics and Machines:
Molecular electronics: Working of Molecular and supramolecular switches, transistors and wires. Molecular machines: Working of Molecular motors, rotors, cars, elevators and valves.

TEXTBOOKS:

REFERENCES:

CHY257  
**BIOMATERIALS SCIENCE**  
3 0 0 3

**Unit 1**
**Introduction:** Bulk properties, Surface properties and characterization - polymers, silicone biomaterials, medical fibres and biotextiles - Smart polymers - bioresorbable and bioerodible materials - natural materials, metals and ceramics - physicochemical surface modification.

**Biocompatibility concepts:** Introduction to biocompatibility - cell material interaction – types of materials - toxic, inert, bioactive - long term effects of materials within the body - cell response.

**Unit 2**
Chemical and biochemical degradation of polymers - degradation of metals and ceramics - calcification of biomaterials.

**Host reactions and their evaluation:** Inflammation and foreign body response - adaptive immunity - systemic toxicity and hypersensitivity - blood coagulation and blood materials interaction.

**Unit 3**
Biological testing of biomaterials: Invitro and invivo assessment of tissue compatibility - evaluation of blood materials interaction - microscopy in biomaterials.

**Practical aspects of biomaterials:** Bioelectrodes, biomedical sensors and biosensors - sterilization of implants - implant failure - implant retrieval and evaluation.

**TEXTBOOK:**

**REFERENCES:**

CHY258  
**ENVIRONMENTAL CHEMISTRY**  
3 0 0 3

**Unit 1**
**Air and air pollution (earth’s atmosphere):** Regions - ozone - CFC and other chemicals - catalytic decomposition of ozone - ‘ozone hole’ formation - Air pollution due to gas emission from industries - Atmospheric aerosols – dust, combustion products, aerosol concentration and lifetimes - Automobile exhausts, smog and effects - Acid rain - chemistry of acid rain, roll of meteorology, greenhouse gases and global warming - air pollution due to jet engines.

**Water and water pollution (hydrosphere):** Physical and chemical properties of water - microbiological processes - carbon, nitrogen cycles - Water pollution - polluting agents - indices of pollution, heavy metal pollution and toxicity - BOD and COD determination - suspended solids - determination of other ions by photometric methods - Chemistry of anaerobic process, use of Effective Microorganisms.

**Unit 2**
Aerobic processes - wastewater treatment systems (brief description only) - anaerobic and aerobic - sewage treatment, primary, secondary and tertiary processes - water reuse and recycle.

**Unit 3**
Other types of pollution: Soil pollution - agricultural pollution - use of chemical fertilizers - Organic chemicals and environment, dioxins and furans - chemistry of some of the pesticides, insecticides and herbicides, ill effects due to uncontrolled use - Bulk storage of hazardous chemicals and disasters, Radioactive pollution, radiation units, sources - exposure and damage - safety standards - radioactive wastes and their disposal - Toxicological substances, testing of toxic substance, enzyme inhibition and biochemical effects of toxic chemicals on humans.

**Sampling and Measurements of Pollutants:** Sampling and analysis techniques of air pollutants (brief outline only) - analysis of particulate matter and lead - Sampling and measurements of water pollutants - organic loadings, phosphates and nitrogen compounds - monitoring of water quality - water test kits, various analytical methods (brief outline only).

**TEXTBOOKS:**
REFERENCES:

CHY259 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3

Unit 1
Separation Techniques: Brief out line of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2
Gas chromatography - principle and applications – gel chromatography.
Electro analytical techniques: Potentiometry - Potentiometric titration - determination of equivalence point - acid base, complexometric, redox and precipitation titrations - merits and demerits. Voltammetry - Cyclic voltammetry - basic principle and application - Polarography - introduction - theoretical principles - migration current - residual current - half wave potential - instrumentation - analytical applications.

Unit 3
Thermal and Diffraction techniques: Principles and applications of DTG - DTA - DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

TEXTBOOKS:

REFERENCES:

CHY260 ORGANIC SYNTHESIS AND STEREOCHEMISTRY 3 0 0 3

Unit 1
Nomenclature of Organic compounds: Polyenes, Alkynes with and without functional groups by IUPAC nomenclature. Aromatic and Heteroaromatic systems - nomenclature of heterocycles having not more than two hetero atoms such as oxygen, sulphur, nitrogen.
Stereochemistry: Tactility, R/S system of nomenclature of central and axial molecules.

Unit 2
Atropisomerism - isomerism of biphenyls - allenes and spiranes - ansa compounds - Geometrical isomerism, E, Z Isomerism. Asymmetric synthesis.

Conformational Analysis: Optical activity and chirality - Conformational Analysis of cyclic and acyclic system - Conformational effects on reactivity of acyclic systems only.

Unit 3

TEXT BOOKS:

REFERENCES:

CHY261 UNIT PROCESSES IN ORGANIC SYNTHESIS 3 0 0 3

Unit 1
Application of Thermodynamics in Organic Unit Processes: free energy, bond energies and entropy. Concepts of aromaticity - Hückel’s rule - anisotropy. Intermediates - carbocations, carbanions, free radicals, carbenes and nitrenes. Reagents in organic synthesis: Grignard reagents, Organolithium reagents, selenium...
dioxide, chromium trioxide, lead tetraacetate, sodium borohydride, lithium borohydride, sulphur carbanions.

Unit 2

Unit 3
**Sulphonation and sulfation:** Sulphonating and sulphating agents – their principal applications – chemical and physical factors in sulphaonation and sulphation – kinetic, thermodynamics and mechanism – the desulphonation reaction.

**Amination:** Amination by reduction – methods of reduction – catalytic, metal and acid, sulphide and electrolytic reductions – amination by ammonolysis- aminating agents – catalysts used in amination reactions – technical manufacture of amino compounds – ammonia recovery system.

**Catalysis by organometallic compounds:** Synthesis gas (Ruthenium and Rhodium metal catalyst).

**TEXTBOOK:**

**REFERENCES:**

**CHY262 MEDICINAL ORGANIC CHEMISTRY 3 0 0 3**

Unit 1
**Medicinal Chemistry:** Introduction, drugs - classification of drugs - mechanism of drug action. Drug-receptor complex nomenclature - agonist, antagonist.

**Physicochemical properties in relation to biological action:** solubility, partition coefficient, dissociation constant, hydrogen bonding, ionization, drug shape, surface activity, complexation, protein binding, molar refractivity, biososterism - Stereo chemical aspects of drug action-stereo isomerism-optical isomerism.

Unit 2
**Enzymes and hormones:** Enzymes - nomenclature, classification and characteristics of enzymes - mechanism of enzyme action, factors affecting enzyme action, cofactors and co-enzymes, enzyme inhibition, enzymes in organic synthesis. Hormones and vitamins - representative cases.

**Medicinal agents from natural products:** Natural products as therapeutic agents, medicinal plants, animal products as medicine, isolation methods of alkaloids, terpenes, anti-oxidants.

Unit 3
**Medicinal agents:** Medicinal agents belonging to steroids, polypeptides, modified nucleic acid bases, sulphamidae and sulpha drugs, antibiotics, antifungal, antiseptics and disinfectants, anesthetics, antihypertensive drugs, analogesics, histamine and anti-histamine agents.

**TEXTBOOKS:**

**REFERENCES:**
rearrangement - reaction mechanism in basic media - Mannich reaction - enols and enolates.

**Reaction involving acids and other electrophiles:** Carbocations - formation and rearrangements - cationic rearrangement involving electron deficient nitrogen atom - Beckmann rearrangement - Curtius, Lossen and Schmidt rearrangement - electrophilic additions - acid catalyzed reaction of carbonyl compounds - hydrolysis of carbocyclic acid derivatives - electrophilic aromatic substitution - carbenes and benzynes - Baeyer-Villiger reactions - Dienone-phenol rearrangement - pinacol rearrangement.

Unit 3

**Radical and radical ions:** Formation of radicals, radical chain processes, radical addition, reaction with and without cyclisation - fragmentation reaction - rearrangement of radicals - $S_{RN}$ 1 reaction - radical ions - Birch reduction - Hofmann-Löffler-Freytag reaction - Barton reaction - McMurry reaction.


**TEXTBOOK:**

**REFERENCES:**

**CHY264 GREEN CHEMISTRY AND TECHNOLOGY 3 0 0 3**

Unit 1
Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

**CHY270 CORROSION SCIENCE 3 0 0 3**

Unit 2
Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behavior and solvent attributes of supercritical $\text{CO}_2$, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetical medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and $\text{CO}_2$ fixation, green plastics, green oxidations, etc.

Unit 3
Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

**REFERENCES:**
1. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.
CHY271 ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES 3 0 0 3

Unit 1
Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2
Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated lead acid) - sealed lead acid, nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account) Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Electrochemical Processes: Principle, process description, operating conditions, process sequence and outline of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

TEXTBOOKS:

REFERENCES:

CHY272 COMPUTATIONAL CHEMISTRY 3 0 0 3 AND MOLECULAR MODELLING

Unit 1
Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.


Introduction to Quantum mechanics - Schrodinger equation - Position and momentum - MO formation - Operators and the Hamiltonian operator - The quantum oscillator - Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2
Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel’s MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel’s theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel’s coefficient matrix - Wheeland’s method -
Hoffmann’s EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3
Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman’s theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments-mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes - Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction to molecular simulation - M.D. simulation.

TEXTBOOKS:

REFERENCES:

REFERENCES:

CSE100 COMPUTER PROGRAMMING 3 0 0 3

Unit 1
Introduction to problem solving - algorithm development, flowcharting. C fundamentals, datatypes, variables, constants, enumerations, operators, bitwise operators, expressions, type cast, data input and output statements - formatted & unformatted, control structures - if, if else, switch.. case, while loop, do.. while, for loop, continue, break, goto. Arrays – defining an array, processing an array, multidimensional arrays.

Unit 2
Strings, string handling functions. User defined functions - defining a function, function prototypes, calling a function, passing arguments to a function, recursion. Variable scope - auto, extern, static, register. Pointers - declarations, call by reference, functions returning pointer, pointer arithmetic. Pointer to pointer, pointers and arrays - pointer to array, array of pointers, dynamic memory allocation - malloc(), calloc(), free().

Unit 3

CSE180 COMPUTER PROGRAMMING LAB. 0 0 3 1

1. Programs using various input/output statements (scanf, printf, getchar, gets, puts, putchar)
2. Programs using bitwise operators and enumerated data types
3. Programs using control structures (if, if else, switch, & loops)
4. Programs using numeric one dimensional array
5. Programs using numeric multidimensional array
6. Programs using strings & string handling functions
7. Functions using static, external and auto variables
8. Programs using recursive functions
9. Programs using call by reference and pointer arithmetic
10. Pointer to array & array of pointers using dynamic memory allocation
11. Structures – arrays, structure within structure
12. Array of structures, unions
13. Programs using text files
14. Programs using binary files
15. Programs using random access of files
16. Programs using command line arguments

CUL101 CULTURAL EDUCATION I 2 0 0 2

Unit 1
Introduction to Indian Culture; Introduction to Amma's life and Teachings; Symbols of Indian Culture;

Unit 2
Science and Technology in Ancient India; Education in Ancient India; Goals of Life – Purushurthas; Introduction to Vedanta and Bhagavad Gita;

Unit 3
Introduction to Yoga; Nature and Indian Culture; Values from Indian History; Life and work of Great Seers of India (1)
CUL102  CULTURAL EDUCATION II  2002

Unit 1
Bhagavad Gita and Life Management; Historicity of Ramayana and Mahabharata; Overview of Patanjali’s Yoga Sutras;

Unit 2
Highlights of Indian Mythology; Indian Society: Its Strengths and Weaknesses; Role & Position of Women in Indian Society;

Unit 3
Indian Models of Economy, Business and Management; Health and Lifestyle related issues; Conservation of cultural heritage; Life and work of Great Seers of India (2)

CUL151  ACHIEVING EXCELLENCE IN LIFE - 1022  AN INDIAN PERSPECTIVE

Objectives: The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.

Unit 1
Goals of Life – Purusharthas
What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life; & Professional life; Followed by a Goal setting workshop;

Yogic way of Achieving Life Goals – (Stress Free & Focused Life)
Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop);

Experiencing life through its Various Stages
Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2
Personality Development
CUL152  EXPLORING SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

Objectives: This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as actual techniques.

Unit 1
1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2
6. Astronomy & mathematics in Jain and Buddhist literature;
7. The transition to the Siddhantic period; Aryabhata and his time;
8. The Aryabhatiya: concepts, content, commentaries;
9. Brahmagupta and his advances;
10. Other great Siddhantic savants;
11. Bhaskara II and his advances;

Unit 3
12. The Kerala school of mathematics;
13. The Kerala school of astronomy;
14. Did Indian science die out?;
15. Overview of recent Indian scientists, from S. Ramanujan onward;
16. Conclusion: assessment and discussion;

TEXTBOOK:
Indian Mathematics and Astronomy: Some Landmarks, by S. Balachandra Rao

REFERENCE:
IFIH's interactive multimedia DVD on Science & Technology in Ancient India.

CUL153  EXCELLENCE IN DAILY LIFE

Unit 1
1. The anatomy of ‘Excellence’. What is ‘excellence’? Is it judged by external factors like wealth?
2. The Great Flaw. The subject-object relationship between individual and world. Promote subject enhance excellence.

CUL154  YOGAPSYCHOLOGY

Objectives: This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. The course includes experiential components centering on meditation and spiritual practice.

Unit 1
Introduction
Introduction to Modern Psychology
A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.
Introduction to Indian Psychology
What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of all Yoga-schools.

Patanjali Yoga Sutra – 1

Patanjali Yoga Sutra – 2

Patanjali Yoga Sutra – 3
Two formulae - Necessity of Abhyasah and Vairagyah - Foundation of Abhyasah
- Foundation of Vairagyah.

Patanjali Yoga Sutra – 4

Patanjali Yoga Sutra – 5
Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.

Patanjali Yoga Sutra – 6

Patanjali Yoga Sutra – 7

Unit 3

Patanjali Yoga Sutra – 8

Patanjali Yoga Sutra – 9

Patanjali Yoga Sutra – 10
Asanam – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses.

Report review

Conclusion

REFERENCES:
- The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
- “The message of Upanishads” written by Swami Ranganathananda. Published by Bharathiya Vidya Bhavan.
- Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda. Published by Advaita Ashram, Uttarjanal.
- ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India
- The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
- “The message of Upanishads” written by Swami Ranganathananda. Published by Bharathiya Vidya Bhavan.
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- Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda. Published by Advaita Ashram, Uttarjanal.
- ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

CVL200

ENGINEERING GEOLOGY

Unit 1
Introduction - the need for imparting geological training to the Civil Engineers.


Volcanoes: types and causes of volcanism, volcanic products, types of volcanic eruptions and their distribution.

Landslides: terminology, classification, causes & control of landslides.

Unit 2
Mineralogy: physical properties of minerals – characteristic features of mineral groups: Quartz, Feldspar, Pyroxene, Amphibole and Mica group. Other minerals and ores - Sillimanite, Kyanite, Staurolite, Asbestos, Talc, clay minerals – Kaolinite, Montmorillonite and Illite, Bauxite, Haematite, Magnetite, Calcite, Barite, Gypsum, Galena, Graphite, Coal and Petroleum.

Petrology: three–fold classification of rocks, characteristic features of igneous, sedimentary and metamorphic rocks – elementary classification, textures and structures of the three groups of rocks. Description, distribution and economic uses of the three groups of rocks. Details of special Indian rocks - Charnockite, Khondalite, deccan traps. Brief description of Granite, Basalt, Dolerite, Syenite, Sandstone, Shale, Limestone, Slate, Schists, Gneisses, Quartzite and Marble.

Unit 3
Structural geology: types and classification of structures (joints, unconformities, folds & faults) and their effect on civil engineering projects.

Hydrogeology: groundwater and occurrence, investigations, quality, artificial recharge, saline water intrusion in coastal aquifers.

Geology in Civil Engineering: tunnels, dams, reservoirs, bridges, runways, roads and buildings. Remote sensing and GIS investigations in Geology.

TEXTBOOKS:

REFERENCE BOOKS:

CVL201 SURVEYING 3 1 0 4

Unit 1
Introduction - classification of surveys – reconnaissance - principle of working from whole to part – provision of control – conventional signs.

Unit 2

Unit 3
Curves and curve setting by various methods.

TEXTBOOKS:

REFERENCE BOOKS:
CVL211 CONSTRUCTION MATERIALS 2002

Unit 1
Commonly used building materials - relationship between material structure and properties.
Natural materials - building stones, clay products, timber and wood based products - classification, properties, testing and selection criteria.

Unit 2
Lime, gypsum, cement - types, properties, tests - mortar.

Unit 3
Bituminous materials – types and properties of asphalt, bituminous concrete.
Modern construction materials – paints, glass, polymers and plastics, adhesives, composites and smart materials.

TEXTBOOKS:

REFERENCE BOOKS:

CVL212 STRUCTURAL ANALYSIS 3104

(Pre-requisite: CVL210)

Unit 1
Statically indeterminate structures - degree of static and kinematic indeterminacies. Introduction to force and displacement methods of analysis.
Energy principles – Castigliano’s theorems - Engesser’s theorem - Maxwell Bett’s theorem - principle of least work – method of virtual work (unit load method) - applications in statically determinate and indeterminate structures.
Analysis of propped cantilever and fixed beams.

Unit 2
Cables – maximum tension – types of supports – forces in towers – suspension bridges with three and two hinged stiffening girders.

Theory of arches – Eddy’s theorem – analysis of three hinged and two hinged arches – settlement and temperature effects.

Unit 3
Moving loads and influence lines – influence lines (IL) for statically determinate beams for reaction, SF and BM – effect of moving loads – concentrated and uniformly distributed loads – load position for maximum BM and SF - equivalent UDL.
IL for determinate structures – truss, arch and suspension bridge.

TEXTBOOKS:

REFERENCE BOOKS:

CVL213 BUILDING TECHNOLOGY 3003

Unit 1
Loads on buildings; foundations - deep and shallow foundations – introduction to
Syllabi  B. Tech. - Civil Engg.  2010 admissions onwards

Unit 1
Mat and grillage foundations – caissons.
Superstructure - load bearing masonry - brick and stone masonry, arches, lintels, scaffolding, shoring; plastering and pointing.

Unit 2
Roofs and Floors - flat and pitched roofs, floor finishes; Doors and windows.
Damp proofing techniques.
White washing, colour washing, painting and distempering;
Concrete construction – batching, mixing, conveying, placing, compacting and curing - under water concreting - form work - prestressed concrete - prefabricated construction - recent developments in concreting.

Unit 3
Tall buildings – structural systems – steel and concrete framed construction.
Vertical transportation, plumbing systems, electrical services.
Acoustics - requirements for good acoustics - sound insulation.
Thermal insulation of buildings - natural and mechanical ventilation - air conditioning.
Principles of fire resistant construction.
Construction equipment – equipment for excavation, transport, hoisting, piling, and concrete construction.

Textbooks:

Reference Books:

CVL220  PRINCIPLES OF FLUID MECHANICS  2 1 0 3

Unit 1
Elementary concepts – density, specific weight, specific gravity, viscosity - dynamic and kinematic viscosity – surface tension, capillarity, vapour pressure, compressibility concept of gauge and absolute pressure, measurement of pressure using manometers of different types.
Hydrostatic force on plane and curved surface – center of pressure – buoyancy and stability of submerged and floating bodies - metacentric height - period of oscillation.

Unit 2
Types of flow, definitions and explanations of unsteady, steady, non-uniform, laminar and turbulent flows. Ideal flow - rotational and irrotational, stream function, potential function. Path line, streak line and stream line continuity equation – derivation, application of one dimensional steady flow – circulation and vorticity - basic flow fields such as uniform flow, source, sink, doublet, vortex flow, spiral flow – superposed flows.
Derivation of Bernoulli’s energy equation and Euler’s equation, examples illustrating the use of energy equation. Flow meters - venturimeter. Orifice meter, nozzle, derivation of equations of discharge, pitot tubes – applications to flow measurements.

Unit 3
Boundary layer theory, boundary layer equation - Blasius solution, drags on flat plate, boundary layer separation and its control. Laminar flow through circular pipe – shear stress, pressure gradient, velocity profile, Hagen-Poiseule equation, power calculations, laminar flow between parallel plates - Couette flow and Poiseule flow.

Textbooks:

Reference Books:

CVL221  HYDRAULIC ENGINEERING  3 1 0 4
(Pre-requisite: CVL220)

Unit 1
Open channel flow in rigid boundary channels - comparison with pipe flow, classification of flow, uniform flow – equations for uniform flow such as Chezy’s and Manning’s formula, most efficient channel sections - rectangular, trapezoidal and circular shapes – circular cross section not flowing full – velocity distribution in open channels - critical depth – specific energy and specific force diagram.
Non-uniform flow – characteristics of non-uniform law – hydraulic jump, hydraulic jump equation for a rectangular channel - practical applications - back water curves - venturiflume – surges.

Unit 2
Dimensional analysis and similitude - Buckingham Pi-theorem – applications – Froude and Reynolds criteria - distorted models – limitations - fixed bed models - movable bed models.

Impulse – momentum principle – application – impact of jet- force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases – torque in rotating machines – jet propulsion.

Unit 3

TEXTBOOKS:

REFERENCE BOOKS:

CVL230 SOIL MECHANICS 3 1 0 4

Unit 1


Unit 2
Seepage through soils: total, neutral and effective stresses – quick sand condition – seepage through soils – flownets: characteristics and uses.

Stress distribution in soils: Boussinesq’s and Wester gaard’s theories for point loads and areas of different shapes – Newmark’s influence chart.

Compaction: mechanism of compaction – factors affecting – effects of compaction on soil properties – field compaction equipment - compaction control.

Unit 3
Consolidation: stress history of clay; e-p and e-log p curves – magnitude and rate of 1-D consolidation – Terzaghi’s theory.


TEXT BOOKS:

REFERENCE BOOKS:

CVL290 CONSTRUCTION MATERIALS LAB. 0 0 3 1

1. Tests on aggregate for concrete
   (a) Grain size distribution (b) Specific gravity (c) Density (d) Void ratio
   (e) Bulkiness (f) Aggregate crushing value (g) Aggregate impact value.
2. Tests on cement
   (a) Fineness (b) Normal consistency (c) Setting time (d) Compressive strength
3. Tests on tiles.
4. Tests on bricks – crushing strength, water absorption and efflorescence.
5. Workability tests – slump, compaction, V-bee and flow table tests.
6. Compression test on cubes and cylinders – determination of modulus of elasticity.
7. Split test on concrete cylinders and flexure test on concrete.
8. Tests on steel.
9. Basic tests on bitumen.
10. Demonstration of non-destructive testing equipments.

**CVL291 MATERIALS TESTING AND EVALUATION LAB. 0031**

1. Tension test on metals
2. Tensile test on thin wires
3. Compression test
4. Hardness test - Rockwell hardness test - Brinell hardness test
5. Shear test
6. Deflection test on beams
7. Impact test – Izod and Charpy
8. Fatigue test
9. Static bending test
10. Test on springs

**CVL292 FLUID MECHANICS AND MACHINERY LAB. 0031**

1. Verification of Bernoulli’s equation.
2. Determination of coefficient of discharge for a small orifice by a constant head method.
3. Determination of coefficient of discharge for an external mouth piece by variable head method.
4. Calibration of triangular notch
5. Determination of friction factor of pipes
6. Impact of jet on vanes
7. Calibration of Venturimeter, Orificemeter, rotameter and watermeter
8. Determination of metacentric height
10. Efficiency test on centrifugal pump and reciprocating pump.

**CVL293 SURVEY PRACTICAL 1032**

1. Chain & compass survey - traversing and plotting of details
2. Plane table survey - two point & three point problems – traversing
3. Levelling - plane of collimation & rise and fall method
4. Levelling - longitudinal & cross sectioning and contour surveying
5. Theodolite surveying - measurement of angles and traversing
6. Heights and distances by tacheometry and solution of triangles
7. Setting out of simple curves - angular method
8. Study and use of modern instruments – total station & GPS
9. Setting out of building plans

**CVL314 ADVANCED STRUCTURAL ANALYSIS 3104**

(Pre-requisite: CVL210)

Unit 1
Slope deflection method – application to the analysis of statically indeterminate beams with and without settlement of supports - rigid jointed plane frames with and without side sway - gable frames.
Analysis of continuous beams - theorem of three moments.
Sway and non-sway analysis by Moment distribution method and Kani's method.

Unit 2
Beams curved in plan – analysis of cantilever beam curved in plan – analysis of circular beams over simple supports.

Unit 3
Introduction to FEM

**TEXTBOOKS:**

**REFERENCE BOOKS:**

**CVL315 DESIGN OF CONCRETE STRUCTURES 3104**

Unit 1
Introduction to R.C structures – review of basic material properties - concrete and
Syllabi

B. Tech. - Civil Engg. 2010 admissions onwards

**S40**

Unit 1

Design of beams - singly and doubly reinforced rectangular and flanged sections. Serviceability requirements. Behaviour in shear and torsion; analysis and design with and without shear reinforcement - design for bond: development length, splicing, curtailment.

Unit 2

Design of one-way slabs and two-way rectangular slabs (wall-supported) - as per IS 456:2000. Design of compression members: effective length, short columns subject to axial compression with and without uniaxial/biaxial eccentricities - introduction to slender columns.

Unit 3


**TEXTBOOKS:**

**REFERENCES:**
1. Park and Paulay, “Reinforced Concrete Structures”, Wiley India (P) Ltd, 2010
6. IS Codes (SP 23, SP 24, IS 456, IS 875, IS 10262, IS 800, SP 16, IS 883, IS 2750)

**CVL316  DESIGN OF STEEL STRUCTURES  3 1 0 4**

Unit 1

Introduction to structural steel sections, material property, geometric properties, classes of sections, stresses, residual temperature stresses in rolled steel sections.

Unit 2


Unit 3


**TEXTBOOKS:**

**REFERENCES:**

**CVL322  ENVIRONMENTAL ENGINEERING  3 1 0 4**

Unit 1

and advanced treatments – iron and manganese removal - fluoridation and defluoridation - water softening - arsenic removal- desalination - membrane filtration.

Unit 2

Unit 3

TEXTBOOKS:

REFERENCE BOOKS:

CVL323 WATER RESOURCES AND IRRIGATION ENGINEERING 3 1 0 4

Unit 1

Unit 2

Unit 3
Design of lined canals - irrigation canals - Kennedy’s theory and Lacey’s theory - intake structures, canal outlets, canal regulation works - canal falls - canal regulators - canal escapes - surplussing arrangements in minor irrigation tanks - cross drainage works - types and selection of type of cross drainage works. Hydroelectric power: low, medium and high head plants, powerhouse components, microhydel schemes. Flood management, flood mitigation, flood damage analysis.

TEXTBOOKS:

REFERENCE BOOKS:

CVL331 FOUNDATION ENGINEERING 3 1 0 4

(Pre-requisite: CVL230)

Unit 1
programme and preparation of soil investigation report.
Earth slope stability: infinite and finite earth slopes – types of failures – factor of
safety of infinite slopes – stability analysis by Swedish arc method, standard
method of slices, Bishop’s simplified method – Taylor’s stability number – stability
of slopes of earth dams under different conditions.

Unit 2
Earth pressure theories: Rankine’s theory of earth pressure – earth pressures in
layered soils – Coulomb’s earth pressure theory – Culmann’s graphical method.
Retaining walls: types of retaining walls – stability of retaining walls.
Shallow foundations: types - choice of foundation – location of depth – safe
bearing capacity – Terzaghi, Meyerhof, Skempton and IS Methods
Safe bearing pressure based on N-value – allowable bearing pressure; safe
bearing capacity and settlement from plate load test – allowable settlements of
structures – settlement analysis.

Unit 3
Pile foundation: types of piles – load carrying capacity of piles based on static pile
formulae – dynamic pile formulae – pile load tests - load carrying capacity of pile
groups in sands and clays – settlement of pile groups.
Well foundations: types - different shapes of wells – components of wells –
functions and design.
Design criteria – sinking of wells – tilts and shifts.

TEXTBOOKS:

REFERENCE BOOKS:

CVL332 TRANSPORTATION ENGINEERING I 3 1 0 4

Unit 1
Highway engineering: introduction to transportation systems and study of system
characteristics; classification of roads; highway planning; geometrical design –
road cross sections, sight distance and applications, super elevation, horizontal
and vertical alignment.

Unit 2
Traffic regulations and control: traffic signs, signals, markings, island and
rotaries; traffic signals – basic concept and principles, analysis and design; types
and layouts – at-grade and grade separated intersections; parking facilities; intelligent
transportation systems (ITS) – components, ATMS and ATIS and applications.
Transportation planning: concept of travel demand and its modeling based on
consumer behaviour of travel choices, independent variables and travel attributes;
sequential, sequential recursive and simultaneous processes; definition of study
area and zoning: elements of transportation network; four stage demand modeling
 technique – trip generation, distribution, mode split and route split models.

Unit 2
Railway and tunnel engineering: components and geometrical design of railways
– horizontal curves, radius, super elevation, cant deficiency, transitional curves,
different types of gradients, grade compensation, points and crossings and their
duals and harbour engineering: definition of terms; design considerations; navigational facilities; inland water transport and container transportation.

TEXTBOOKS:

REFERENCE BOOKS:

CVL390 DESIGN AND DRAWING (RCC AND STEEL STRUCTURES) 1032

Design drawing and detailing of RC elements/structures – to prepare detailed design documents, schedules of structural elements and reinforcement details (structural drawing)
Continuous beams, columns and slab systems
Isolated and combined footings (axially loaded and eccentrically loaded)
Staircase
Retaining walls
Elevated water tanks
Design and detailing of steel elements/structures
Beams and beam-column joints
Built-up columns
Column bases (axially loaded and eccentrically loaded)
Roof trusses and joints including purlins
Gantry girder

REFERENCE BOOKS:

CVL391 GEOTECHNICAL ENGINEERING LAB. 0031

1. Specific gravity of coarse and fine-grained soils
2. Grain size analysis
3. Atterberg’s limits and indices
4. Determination of field density (a) sand replacement method (b) core cutter method
5. Determination of coefficient of permeability by (a) constant head method; (b) variable head method
6. Consolidation test
7. Compaction test (a) IS light compaction test (b) IS heavy compaction test
8. California bearing ratio test
9. Direct shear test
10. Triaxial shear test
11. Unconfined compressive strength test & laboratory vane shear test
12. Demonstration of plate load & standard penetration tests

CVL392 ENVIRONMENTAL ENGINEERING LAB. 0031

1. Determination of solids (total, dissolved, organic, inorganic and settleable) in water
2. Determination of turbidity and the optimum coagulant dose
3. Determination of alkalinity and pH of water
4. Determination of hardness and chlorides in water
5. Determination of iron and manganese in water
6. Determination of sulphates and sulphides in water
7. Determination of D.O
8. Determination of available chlorine in bleaching powder and the chlorine dose required to treat the given water sample
9. Determination of coliforms in water
10. Determination of B.O.D and C.O.D
11. Demonstration of Instrumental methods of pollutant analysis

REFERENCE:
Standard method for the examination of water and waste water, 2005, APHA, AWWA, WPCF Publication.
CVL393  BUILDING DRAWING  1 0 3  2

Part - A
Detailed drawing of components
• Doors, windows and ventilators
• Roof trusses
• Reinforced concrete staircase

From given line sketch and specification, develop working drawings of:
• Single storied residential building with flat and tiled roof
• Public buildings like office, dispensary, post office, bank etc.
• Factory building with trusses

Part – B
Building byelaws and regulations - space planning of buildings - residential, public and commercial – design process – activity areas and linkages – proximity matrix – adjacency diagram – form development with respect to site conditions and functional requirements – preparation of drawings – presentation techniques - computer aided design and drafting.

Planning, designing from given requirements of areas and specifications and preparation of drawings. (AutoCAD).
Residential building - flat and pitched roof, economic domestic units, cottages, bungalows
Public building – small public utility shelters, dispensaries, banks, schools, offices, libraries, hostels, restaurants, commercial complexes, factories etc.
Preparation of site plans and service plans as per Building rules.

TEXTBOOKS:

REFERENCE BOOKS:

CVL450  CONCRETE TECHNOLOGY  3 0 0  3

Unit 1
Materials: cement - different types - chemical composition and physical properties
- tests on cement - I.S. specifications - aggregates - classification - mechanical properties and tests as per I.S. - alkali aggregate reaction - grading requirements - heavy weight - light weight - normal weight - aggregate - sampling of aggregate - water - quality of water - admixtures - accelerators - retarders - water reducing agents – super plasticizers- use of silica fumes.
Properties of fresh concrete - workability - factors affecting workability - tests for workability - segregation and bleeding.

Unit 2

Unit 3
Introduction to non-destructive test methods.

TEXTBOOKS:

CVL451  ADVANCED CONCRETE DESIGN  3 0 0  3

(Pre-requisite: CVL315)

Unit 1
Deep beams - analysis - design as per BIS - design using strut and tie method.
Chimneys: analysis of stresses in concrete chimneys - uncracked and cracked

Schools of Engineering  Amrita Vishwa Vidyapeetham  S 47

S 48
sections - codal provisions - design of chimney.
Water tanks: Introduction - rectangular and circular with flat bottom - spherical and conical tank roofs - staging - design as per BIS.

Unit 2

Unit 3
Design of slab culvert – RC box culverts – T-beam bridges – concept on design of continuous bridges, balanced cantilever bridges, arch bridges and rigid frame bridges.

TEXTBOOKS:

REFERENCE BOOKS:
5. BIS codes (IS 456, IS 2210, IS 4998, IS 3370, SP 16, SP 24, SP 34).
6. IRC Codes (IRC 5, IRC 6, IRC 21)

CVL452 ADVANCED STEEL DESIGN
(Pre-requisite: CVL316)

Unit 1
Gantry girder - design of gantry girder – gantry to column connection.

CVL453 PRE-STRESSED CONCRETE DESIGN
(Pre-requisite: CVL315)

Unit 1

Unit 2
Strength of prestressed concrete sections in flexure, shear and torsion: Types of flexural failure – strain compatibility method – IS code procedure – design for limit state of shear and torsion.

Unit 3
Design of prestressed concrete beams and slabs:
Transfer of prestress in pre tensioned and post tensioned members – design of anchorage zone reinforcement – design of simple beams – cable profiles – design of slabs.

TEXTBOOK:
REFERENCES BOOKS:
4. IS 1343-1980, “Code of Practice for Prestressed Concrete”. BIS.

CVL454 INDUSTRIAL STRUCTURES 3 0 0 3
(Pre-requisite: CVL316)

Unit 1
Functional design of industrial buildings.
General overview of thermal power plant/nuclear power plant structures/process plant steelwork – conveyor structures – boiler supporting structures -substation structures.

Unit 2
Machine foundations – types - design requirements - analysis and design of block type machine foundations (IS 2974 method).

Unit 3
Design of reinforced concrete bunkers and silos as per IS:4995.
Tall chimneys (RCC) – types - chimney sizing parameters - overview of wind and temperature effects - design principles of reinforced concrete chimneys as per IS:4998.
Cooling towers – types and functions - design principles of RC natural draught cooling towers as per IS:11504.

TEXTBOOKS:

REFERENCE BOOKS:

CVL455 STRUCTURAL DYNAMICS AND SEISMIC DESIGN 3 0 0 3

Unit 1

Unit 2
Base-excited SDOF system - formulation of basic equation – concepts of pseudo acceleration, velocity and displacement - earthquake response spectra (concept) - lumped mass modelling of multi-storey shear building and modes of vibration (concepts only - demonstration with example). Performance of building and structures under earthquakes - main causes and effects - assessment of damage. Philosophy and principles of earthquake resistant design - IS specifications.

Unit 3

TEXTBOOKS:
SYLLABI

B. Tech. - Civil Engg. 2010 admissions onwards

CVL456
FINITE ELEMENT METHODS 3 0 0 3

Unit 1
Boundary value problems and the need for numerical discretisation: introduction, examples of continuum problems, history of finite element method. Weighted residual methods: approximation by trial functions, weighted residual forms, piecewise trial functions, weak formulation, Galerkin method, examples of one- two- and three-dimensional problems. Higher order finite element approximation: degree of polynomial in trial functions and rate of convergence, the patch test, shape functions for C0 and C1 continuity, one-, two- and three-dimensional shape functions.

Unit 2

Unit 3
Generalised finite elements and error estimates: the generalised finite element method, the discretisation error in a numerical solution, measure of discretisation error, estimate of discretisation error. Coordinate transformation: transformation of vectors and tensors, transformation of stiffness matrices, degree of freedom within elements, condensation, condensation and recovery algorithm, substructuring, structural symmetry.

CVL457
SMART MATERIALS AND STRUCTURES 3 0 0 3

Unit 1

Unit 2

Unit 3
SYLLABI
B. Tech. - Civil Engg. 2010 admissions onwards

TEXTBOOKS:

REFERENCE BOOKS:

CVL458 MAINTENANCE AND REPAIR OF BUILDINGS 3 0 0 3
(Pre-requisite: CVL213)

Unit 1
Durability: life expectancy of different types of buildings – influence of environmental elements such as heat, moisture, precipitation and frost on buildings - effect of biological agents like fungus, moss, plants, trees, algae - termite control and prevention - chemical attack on building materials and components - aspects of fire damage and assessment - impact of pollution on buildings.

Unit 2
Common defects in buildings and measures to prevent and control the same - maintenance philosophy - phases of maintenance – routine preventive and curative maintenance.

Non-destructive testing methods
Materials for repair - special mortar and concretes, concrete chemicals, special cements and high grade concrete – admixtures of latest origin

Unit 3

CVL459 FUNCTIONAL DESIGN OF BUILDINGS 3 0 0 3
(Pre-requisite: CVL213)

Unit 1
Introduction to functional design – principles.


Unit 2

Unit 3


**SYLLABI**

**B. Tech. - Civil Engg.**

2010 admissions onwards

**CVL461**

**GROUND WATER HYDROLOGY** 3 0 0 3

Unit 1

Unit 2
Unsteady flow - general equation - Cartesian and polar coordinate - unsteady radial flow in to a well - confined, unconfined and leaky aquifers - multiple well system - pumping tests - non equilibrium equation for pumping tests - Thies' method - Jacob method - Chow's method - characteristics well losses - step draw down test - well near aquifer boundaries - determination of boundaries from pumping test. Image wells for various boundary conditions - cavity well and open well - yield tests - pumping and recuperation test.

Unit 3
Tube wells: design - screened wells - gravel packed wells - well loss - selection of screen size - yield of a well - test holes - well logs - methods of construction - dug wells - shallow tube wells - deep wells - gravity wells - drilling in rocks - screen installation - well completion - well development - testing wells for yield - collector - or radial wells - infiltration galleries - well point system - failure of tube wells. Ground water investigation methods.

**TEXTBOOK:**

**REFERENCE BOOKS:**

**CVL462**

**WATER RESOURCE SYSTEMS PLANNING AND DESIGN** 3 0 0 3

(Pre-requisite: CVL323)

Unit 1
Water systems engineering – scope and approach.
Issues and the systems planning approach - water system dynamics - water resource development alternatives – water systems planning objectives - constraints and criteria – economic and econometric principles.
Hydrologic input analysis, demand analysis, system elements & subsystem planning - stochastic planning and management - design and management issues.

Unit 2
Optimization methods and their application in W.R. systems. Linear programming and dynamic programming models. Problem formulation for W.R systems – multi-objective planning – large scale system analysis - Case studies.

Unit 3
Ground water system planning – conjunctive surface and G.W development - hierarchical approach - water quality management planning - regional planning - policy issues.

**TEXTBOOK:**

**REFERENCE BOOKS:**
CVL463 REMOTE SENSING AND GIS 3 0 0 3

Unit 1
Introduction, basic concepts and principles of remote sensing; definition components of remote sensing - energy sensor, interacting body – active and passive remote sensing – platforms - EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface. Application; meteorology, land use, networking, hydrological studies, soil studies and coastal zone analysis.

Unit 2
Photogrammetry; aerial and terrestrial; photo interpretation. Sensors; radar imaging; colour scanners; thematic mapper.


Unit 3
Analysis using raster and vector data – retrieval, reclassification, overlaying, buffering - data output – printers and plotters. Open source softwares.

GIS and remote sensing applications – urban applications – water resources – urban analysis – watershed management – resources information system – hazard mitigation.

TEXTBOOKS:

REFERENCES:
SYLLABI  B. Tech. - Civil Engg.  2010 admissions onwards

Unit 2
Treatment of industrial waste - suitability of different techniques - disposal of industrial waste.

Unit 3
Environmental impact of textile industry – paper industry - dairy - fertilizer – thermal power plant.
Study of damages caused by industrial pollution in India.

REFERENCE BOOKS:

CVL466  COASTAL ENGINEERING  3 0 0 3

Unit 1
Wave generation and propagation: definition - wave generation - wave classification - linear theory of waves - assumptions and derivation of relationships of wave characteristics. Pressure within a progressive wave energy - wave decay - transformation of waves - fundamentals aspects of stokes theory - reflection, refraction, diffraction of waves - breaking of waves, types, criterion; and Importance of breaking.

Unit 2
Waves forces on structures: Wave forces on structures - vertical, sloping, curved and stepped barrier - force due to non-breaking and broken waves - force on piles.
Wave forecasting: need for forecasting - SMB and PNJ methods of wave forecasting.
Tides: origin and classification of tides - Darwin’s equilibrium theory of tides – effects on structures.

TEXTBOOKS:

CVL470  PAVEMENT DESIGN  3 0 0 3

Unit 1
Introduction: types and component parts of pavements - factors affecting design and performance of pavements - comparison between highway and airport pavements - functions and significance of sub grade properties – various methods of assessment of sub grade soil strength for pavement design – cause and effects of variations in moisture content and temperature - depth of frost penetration - design of bituminous mixes by Marshall method.

Unit 2
Stress analyses and methods of flexible pavement design: stresses and deflections in homogeneous masses - burmister 2 layer and 3 layer theories - wheel load stresses - ESWL of multiple wheels - repeated loads and EWL factors - empirical, semi-empirical and theoretical approaches for flexible pavement design - group index, CBR, triaxial, mcleod and burmister layered system methods.

Unit 3
Stresses analysis and methods of rigid pavement design: types of stresses and causes - factors influencing stresses, general conditions in rigid pavement analysis – ESWL - wheel load stresses - warping stresses – friction stresses - combined stresses - functions of various types of joints in cement concrete pavements - design and detailing of slab thickness; longitudinal, contraction and expansion joints by IRC recommendations.
Pavement evaluation and rehabilitation.
SYLLABI
B. Tech. - Civil Engg.
2010 admissions onwards

**TEXTBOOK:**

**REFERENCE BOOKS:**

**CVL471 URBAN TRANSPORTATION PLANNING 3 0 0 3**

**Unit 1**

**Unit 2**
Trip generation analysis: definition of study area - zoning - types and sources of data - road side interviews - home interview surveys - expansion factors - accuracy checks - trip generation models - zonal models - category analysis - household models - trip attractions of work centers. 
Trip distribution analysis: trip distribution models - growth factor models – gravity models.

**Unit 3**
Mode split analysis: mode split analysis - mode choice behaviour, completing modes, mode split curves, probabilistic models.
Route split analysis - route split analysis: elements of transportation networks, coding - minimum path trees, all-or-nothing assignment.

**TEXTBOOK:**

**REFERENCES BOOKS:**

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**CVL472 ADVANCED TOPICS IN TRAFFIC ENGINEERING 3 0 0 3**
(Pre-requisite: CVL332)

**Unit 1**
Traffic stream characteristics and description using distributions: measurements, microscopic and macroscopic study of traffic stream characteristics – flow, speed and concentrations, use of counting, internal and translated distributions for describing vehicle arrivals, headways, speeds, gaps and lags, fitting of distributions, goodness of fit tests.
Traffic stream models: fundamental equation of traffic flow, speed - flow - concentration relationships, normalized relationship, fluid flow analog approach, shock wave theory, platoon diffusion and Boltzman like behaviour of traffic flow, car-following theory, linear and non-linear car-following models, acceleration noise.

**Unit 2**
Queueing analysis: fundamentals of queueing theory, demand service characteristics, deterministic queueing models, stochastic queueing models, multiple service channels, models of delay at intersections and pedestrians crossings.
Highway capacity & level of service studies: concepts, factors affecting capacity & level of service, capacity analysis of different highway facilities, passenger car units, problems in mixed traffic flow.

**Unit 3**
Simulation models: philosophy of simulation, modelling, formulation of simulation model, methodology of system simulation, simulation languages, generation of random numbers, generation of inputs – vehicle arrivals, vehicle characteristics, road geometrics, design of computer simulation experiments, analysis of simulation data, formulation of simulation problems & validation.

**TEXTBOOKS:**

**REFERENCE BOOKS:**
CVL473 TRANSPORTATION SYSTEM MANAGEMENT 3 0 0 3
AND CONTROL

Unit 1
Traffic engineering facilities and control: control of traffic movements through time sharing and space sharing concepts – design of channelising islands - T, Y, skewed, staggered, round-about, mini-round about and other at-grade crossings and provision for safe crossing of pedestrians and cyclists; grade separated intersections, their warrants and design features, bus stop location and bus bay design.
Traffic control devices: traffic signs and signals, principle of signal design, webster's method, redesign of existing signals including Case studies; Signal system coordination.

Unit 2
TSM actions:
Combination and interactions, input assessment and evaluation, monitoring and surveillance, study of following TSM actions with respect to: 1) Problems addressed 2) Conditions for applications 3) Implementation problems 4) Evaluation and impact analysis.
Public transportation and HOV treatment, toll discounts for car pools during peak periods, park and ride, car pooling, exclusive bus & two-wheeler lanes, priority at ramp terminals, bus transfer stations, limited skip & stop bus services & shared Rides.

Unit 3
Demand management: staggered working hours, flexible work hours, high peak period tolls, shuttle services, circulation services and extended routes.
Traffic operations improvements: on-street, parking ban, freeway ramp control and closure, travel on shoulders, one-way streets, reversible lanes, traffic calming, right turn phase, right turn lanes, reroute turning traffic.

TEXTBOOKS:

REFERENCE BOOKS:
1. IRC- SP41-1994: Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas.
CVL475 SOIL DYNAMICS AND MACHINE FOUNDATIONS 3 0 0 3
(Pre-requisite: CVL331)

Unit 1
Introduction - nature of dynamic loads - stress conditions on soil elements under earthquake loading - dynamic loads imposed by simple crank mechanism - type of machine foundations - special considerations for design of machine foundations - theory of vibration: general definitions - properties of harmonic motion - free vibrations of a mass-spring system - free vibrations with viscous damping - forced vibrations with viscous damping - frequency dependent exciting force - systems under transient forces - Raleigh’s method - logarithmic decrement - determination of viscous damping - principle of vibration measuring instruments - systems with two degrees of freedom - special response.

Unit 2
Criteria for a satisfactory machine foundation - permissible amplitude of vibration for different type of machines - methods of analysis of machine foundations - methods based on linear elastic weightless springs - methods based on linear theory of elasticity (elastic half space theory) - methods based on semi graphical approach - degrees of freedom of a block foundation - definition of soil spring constants - nature of damping - geometric and internal damping - determination of soil constants - methods of determination of soil constants in laboratory and field based on IS code provisions.

Unit 3
Vertical, sliding, rocking and yawing vibrations of a block foundation - simultaneous rocking, sliding and vertical vibrations of a block foundation - foundation of reciprocating machines - design criteria - calculation of induced forces and moments - multi-cylinder engines - numerical example (IS code method). Foundations subjected to impact loads - design criteria - analysis of vertical vibrations - computation of dynamic forces - design of hammer foundations (IS code method) - vibration isolation - active and passive isolation - transmissibility - methods of isolation in machine foundations.

TEXT BOOKS:
4. IS 2974 - Part I and II, Design Considerations for Machine Foundations
5. IS 5249: Method of Test for Determination of Dynamic Properties of Soils

CVL480 CONSTRUCTION MANAGEMENT 3 0 0 3

Unit 1

Unit 2

Unit 3
Materials management - inventory control. Transportation model and application for distribution of materials. Management of construction equipment - selection factors - planning of equipment introduction to project management softwares.

TEXTBOOKS:

CVL481 CONSTRUCTION PLANNING AND CONTROL 3 0 0 3

Unit 1
Project planning - objectives - principles of planning - stages of planning - process of resource planning - work force, materials, equipment – scheduling - classification - methods of scheduling - bar charts, milestone charts, network analysis, life cycle
curves - job layout - work brake down structure -- line of balance technique (LOB) -
advantages, scheduling with LOB.

Project management through networks - types of networks - choice of network type.

Unit 2
CPM – advantages and disadvantages; earliest event time; latest event time; float;
criticality and critical activity; illustrative numerical examples.
PERT - advantages and disadvantages; time estimates - earliest expected time;
latest allowable occurrence time, slack, critical path, probability and completion
time for a project - illustrative numerical examples.

Unit 3
Construction project management - objectives - project development process -
project life cycle, inception stage, preparation stage, execution stage, fast track
approach - project management and organizational implications - management
functions - causes of project failure.
Management of construction equipment - factors affecting selection of construction
equipments - planning of construction equipment.
Planning construction costs – classification - direct and indirect costs - unit rate
costing - labour, equipment, materials, break even analysis - standard cost concept
- S-curve chart.

TEXTBOOKS:
2009.

REFERENCES:
India Private Limited, 2006.

CVL491 DESIGN AND DRAWING (WATER RESOURCES ENGG.) 1 0 3 2

Part A
Design and detailed drawing of the following irrigation works:
1. Tank sluice - wing type
2. Tank sluice - weir type

CVL497 SEMINAR 0 0 3 1

Individual students will be asked to choose a topic in any field of Civil Engineering, preferably from outside the B.Tech syllabus and give seminar on the topic for about thirty minutes. A committee will assess the presentation of the seminars.

CVL499 PROJECT 10 cr

The student is expected to work on a topic in the field of Civil Engineering which could involve theoretical and/or fabrication and/or experimental and/or computational work. Evaluation will be done at the mid-course, as well as at the end of the semester.

ECE100 ELECTRONICS ENGINEERING 3 0 0 3

Objective: To understand the working of basic electronic devices such as diodes, BJTs and FETs; Introduce the student to the operation and design of fundamental building blocks of electronic systems like power supplies, amplifiers and oscillators; Develop skills to analyze specifications of simple electronic circuits and carry out their design.

Unit 1
Physics of conductors and semiconductors: conductors, semiconductors, silicon crystals, intrinsic semiconductors, two types of flow, doping a semiconductor, two types of extrinsic semiconductors, unbiased diode, forward bias, reverse bias, breakdown, barrier potential and temperature, reverse biased diode, diode approximations.

Rectifiers and diodes: half wave, full wave and Bridge rectifiers. Filters, choke input filter, capacitor input filter, PIV and surge current, Zener diode, loaded Zener regulator, LED, photo diodes, Schottky diode, Varactor diode.

Unit 2
Basics of amplifiers: Introduction to BJT and FET, BJT characteristic curves and regions of operation, emitter and voltage divider bias of BJT, BJTs as a switch, LED drivers, JFET characteristics, JFET biasing in Ohmic and active regions, transconductance, JFET amplifiers, depletion mode and enhancement mode MOSFET, CMOS.

Unit 3
Operational amplifiers and linear ICs: differential amplifier, introduction to Opamps, inverting and non-inverting amplifier, comparators, instrumentation amplifier, summing amplifier, voltage follower.

Oscillators: Theory of sinusoidal oscillations, Wein Bridge oscillator, Colpitts oscillator, Quartz Crystal oscillator, introduction to 555 Timer, astable and monostable operation.

TEXTBOOK:
REFERENCES:

EEE100 ELECTRICAL ENGINEERING 3 0 0 3

Unit 1
Introduction to electrical engineering, System of units. Electric current, Coulomb’s law, Ohm’s law, Faraday’s law of electromagnetic induction, Kirchhoff’s laws, Ampere’s law.
Ideal independent current and voltage-sources; Reference directions and symbols, energy and power: R, L and C- parameters; Series and parallel combination of resistances, capacitances and inductances, series-parallel circuits, superposition theorem, conversion of a voltage source to current source and vice versa, voltage divider and current divider rule. Network reduction by star–delta transformation, analysis of dc circuits by Mesh-current and nodal methods.

Unit 2
Transient analysis with energy storage elements (for RC-, RL- circuits with DC excitations): Writing differential equations for first order circuits, steady state solution of circuits containing inductors and capacitors, initial and final conditions, transient response of RL and RC circuits (rise and decay).
Sinusoidal steady state analysis: Generation of sinusoidal functions, average and effective values of periodic functions, instantaneous and average power, power factor, phasor representation of sinusoids, response of single elements (R, L and C) for sinusoidal excitation; phasor concept and phasor diagram; Impedance and Admittance concepts; The series RL, series RC and series RLC circuits, complex power and power triangle. Introduction to 3-phase systems; Balanced 3-phase systems (STAR and DELTA connections).

Unit 3
Magnetic circuits: MMF, magnetic flux, reluctance, flux density, analogy with electric...
SYLLABI  B. Tech. - Civil Engg.  2010 admissions onwards

circuits, analysis of magnetic circuits, self and mutual induced emfs, energy stored in a magnetic circuit.
Transformers; construction and principle of operation of transformers, Emf equation.
Three phase induction motor: Types, construction, rotating magnetic field, principle of operation, slip, rotor induced emf.
Measuring instruments, Different types of instruments to measure voltage, current power and energy.

TEXTBOOK:

REFERENCES:

EEE180  WORKSHOP B  1 0 2  2

Electrical workshop:
Study of safety devices such as fuse, MCB, ELCB & earthing – electrical power distribution in domestic installations, study of tools and accessories used in electrical wiring – wiring practice for staircase circuit, fluorescent lamp, hospital wiring and godown lighting – study of domestic appliances like Mije, fan, Electric iron, Air conditioner, Refrigerator – study of different types of electric lamps like Incandescent lamp, Fluorescent, CFL, Metal halide, Mercury vapour, Sodium vapour and halogen lamp.

Personal computer hardware workshop:
Study of basic components in a computer - study of basic components in a network – study of diagnostic tools for system and study of floppy disk controller – study of hard disk controller – drivers for different components – trouble shooting in printer – communication between two computers with null modem – transferring characters from PC to LCD.

Electronics and basic microprocessor workshop:

PIC microcontroller workshop:
Introduction to MP lab simulator. Simulating and burning simple programmes on PIC 16F877A.

ENG111  COMMUNICATIVE ENGLISH  2 0 2  3

Objectives:
To make the students communicate their thoughts, opinions, and ideas freely and naturally.
To make them understand the different styles in communication
To make the students understand the aesthetics of reading and writing
To bring in a spirit of enquiry
To motivate critical thinking and analysis
To help them ruminate on human values

Unit 1
Reading: Different styles of communication – reading comprehension - critical thinking and analysis – note-making.

Unit 2
Writing: Prewriting techniques - kinds of paragraphs - basics of continuous writing; Grammar and usage – topics including spelling and number rules (Workbook).

Unit 3
Practical sessions (listening & speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – listening comprehension and note-taking.
Activities: Short speeches, seminars, quizzes, language games, debates, discussions and book reviews, etc.

TEXTBOOKS:
1. Language through Reading: Anthology compiled by Amrita;
2. Language through practice: Work book compiled by Amrita

REFERENCES:

ENG112  TECHNICAL COMMUNICATION  2 0 2  3

Objectives:
To introduce the students to the elements of technical style
To introduce the basic elements of formal correspondence
To introduce technical paper writing skills and methods of documentation
To improve oral presentation skills in formal contexts
SYLLABI

B. Tech. - Civil Engg. 2010 admissions onwards

Unit 1

Unit 2
Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals - reports – proposals; Formal correspondence: Letter writing, including job applications with resume.

Unit 2

REFERENCES:

ENG250  PROFESSIONAL COMMUNICATION  1 0 2  2

Unit 1
Reading Comprehension: Focus will be on understanding of the given information, vocabulary, inference, logical thinking, and decision - making.

Unit 2

Unit 3
Practical: Telephonic conversations, interviews, group and panel discussions, and oral presentations.

REFERENCES:
Nissim Ezekiel – Farewell Party to Miss Pushpa T S; Rabindranath Tagore – Upagupta.

Unit 2

Unit 3
**Drama and Speech:** Rabindranath Tagore – Chandalika; Mahashwetadevi – Bayen; Swami Vivekananda – Chicago Address; J.Krishnamurthy / C.N.R Rao - Audio speech.

**Short Story:**

**REFERENCES:**
8. Vidya, intranet, Amrita Vishwa Vidyapeetham.

**ENGG253 INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE 1 0 2 2**
(Pre-requisite: Nil;Equivalent course in 2007 curriculum: Nil)

Objectives -
· to expose the students to different genres of Literature
· to inculcate reading skills
· to provide deeper critical and literary insights

**ENV200 ENVIRONMENTAL STUDIES 3 1 0 4**

Unit 1
Overview of the global environmental crisis; Biogeochemical cycles; Climate change and related international conventions and treaties and regulations; Ozone hole and related international conventions and treaties and regulations; Overpopulation; Energy crisis; Water crisis, groundwater hydrogeology, surface water resource development.
Unit 2
Ecology, biodiversity loss and related international conventions, treaties and regulations; Deforestation and land degradation; Food crisis; Water pollution and related international and local conventions, treaties and regulations; Sewage domestic and industrial and effluent treatment; Air pollution and related international and local conventions, treaties and regulations; Other pollution (land, thermal, noise).

Unit 3
Solid waste management (municipal, medical, e-waste, nuclear, household hazardous wastes); Environmental management, environmental accounting, green businesses, eco-labeling, environmental ethics, environmental impact assessment; Constitutional, legal and regulatory provisions; Sustainable development;

TEXTBOOK:

REFERENCE BOOKS:

FRE201 PROFICIENCY IN FRENCH LANGUAGE (LOWER) 1 0 2 2

Unit 1  Population - Identity
How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions;
Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) in the present; Interrogative sentence; Gender of adjectives.

Unit 2  The suburbs - At the train station
Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; The city (church, town hall, post office...)
Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3  Paris and the districts - Looking for a room
Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for the time.
Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:
Metro St Michel - Publisher: CLE international

GER201 PROFICIENCY IN GERMAN LANGUAGE (LOWER) 1 0 2 2

To have an elementary exposure to German language; specifically
1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able to carry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;
5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.
(This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.)

Some useful websites will be given.
GER202 PROFICIENCY IN GERMAN LANGUAGE (HIGHER) 1 0 2 2

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative.

Some German culture. Films.

GER211 GERMAN FOR BEGINNERS I 1 0 2 2

Unit 1
Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation.
Numbers 1-100; Saying the telephone number.
Countries and Languages.
Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.
Vocabulary: Professions.

Unit 2
Giving the personal details. Name, age, marital status, year of birth, place of birth, etc.
Numbers till 1000. Saying a year.
Alphabets – spelling a word.
Filling up an application form; In the restaurant – making an order.
Grammar: Definite, indefinite and negative article in nominative.
Accusative: indefinite and negative Article
Vocabulary: Food items

Unit 3
Number above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion.
Grammar: Accusative – definite article. Adjectives and plural forms.
Vocabulary: Furniture and currencies.

HUM250 INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY 1 0 2 2

Unit 1
Introductory study of the Bhagavad Gita and the Upanishads

Unit 2
The relevance of these classics in a modern age –

Unit 3
Goals of human life-existential problems and their solutions in the light of these classics etc.

REFERENCE:
The Bhagavad Gita, Commentary by Swami Chinmayananda

HUM251 INTRODUCTION TO INDIA STUDIES 1 0 2 2

Preamble:
This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times.
Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Unit 1
A brief outline of Indian history from prehistoric times to the present times.
Contributions of India to world culture and civilization:
Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2
Modern India: Challenges and Possibilities –
Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today – unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3
Modern Indian Writing in English: Trends in Contemporary Indian Literature in English

TEXTBOOK:
Material given by the Faculty

BACKGROUND LITERATURE:
1) Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
2) Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.
3) Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.
4) Outlines of Indian Philosophy, M. Hiriyanna, MLBD.
5) An Advanced History of India, R. C. Majumdar et al, Macmillan.
6) India Since 1526, V. D. Mahajan, S. Chand & Company
7) The Indian Renaissance, Sri Aurobindo.
8) On Nationalism, Sri Aurobindo.
12) Awaken Children: Conversations with Mata Amritanandamayi
13) Indian Aesthetics, V. S. Seturaman, Macmillan.
14) Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.
15) Web of Indian Thought, Sister Nivedita
16) Essays on Indian Nationalism, Anand Kumaraswamy
17) Comparative Aesthetics, Volume 2, Kantil Chandra Pandey, Chowkhamba, Varanasi
Modern India
The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation is born as a republic – the pang of birth and growth; India since Independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.
Conclusion
The Wonder that was India; The ‘politics’ and ‘purpose’ of studying India

REFERENCES:
17. Aurobindo, Sri. The Indian Renaissance / India’s Rebirth / On Nationalism.
25. Danino, Michel. The Invasion That Never Was.
34. Dharampal. Archival Compilations (unpublished)
Unit 1
Introduction
Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization. Ancient India – up to 600 B.C. Early India – the vedic society – the varnasramadharma – socio-political structure of the various institutions based on the four purusartha; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira's ramarajya; Sarasvati - Sindhu civilization and India's trade links with other ancient civilizations; Towards chieftdoms and kingdoms – transformation of the polity; kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2
Classical India: 600B.C. – 1200 A.D. The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's Arthasastra; Of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India's maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya; dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies; political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas Medieval India: 1200 A.D. – 1720 A.D. Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

REFERENCES:
1. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.
SYLLABI

Unit 1
Introduction
Western and Indian views of science and technology
Introduction: Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

Unit 2
Indian sciences
Introduction: Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD Science and technology under the British rule; Introduction: Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3
Science and technology in Independent India
Introduction: An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination. Building upon the Indian tradition
Introduction: Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.
Conclusion

REFERENCES:
18. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.

SYLLABI

JAP201 PROFICIENCY IN JAPANESE LANGUAGE (LOWER) 1022

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations throughout in Japanese class only. Students will be able to make conversations.
with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami—pattern making using paper.

JAP202 PROFICIENCY IN JAPANESE LANGUAGE (HIGHER)  1 0 2 2

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics. By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

MAT111                           CALCULUS, MATRIX ALGEBRA                      3 1 0  4
AND ORDINARY DIFFERENTIAL EQUATIONS

Unit 1
Linear systems of equations, Gauss elimination, rank of a matrix, linear dependence. Solutions of linear systems: existence, uniqueness, general form, eigen values, eigen vectors, some applications of eigen value problems, symmetric, skew-symmetric and orthogonal matrices, complex matrices: Hermitian, Skew Hermitian, unitary, similarity of matrices, basis of eigen vectors, diagonalization. (Sections: 6.3, 6.4, 6.5, 7.1, 7.2, 7.3, 7.4, and 7.5)
Limits and continuity. (Sections (in textbook 1): 2.2, 2.3, 2.4, 2.5, 2.6)

Unit 2
Derivatives, curve sketching, improper integral. (Sections (in textbook 1): 3.1, 4.1, 4.3, 4.4, 8.8)
Basic concepts and ideas, exact differential equations, integrating factors, orthogonal trajectories of curves. (Sections: 1.1, 1.5, 1.8)

Unit 3
Review of linear differential equations and Bernoulli equation, modelling: mixing problem, electric circuits. Review of homogeneous linear equations of second order, Euler-Cauchy equations, solution by undetermined coefficients, solution by variation of parameters. System of linear equation, basic concepts and theory, homogeneous systems with constant coefficients, phase plane, critical points. Criterion for critical points and stability. (Sections: 1.6, 1.7, 2.1, 2.2, 2.3, 2.6, 2.9, 2.10, 3.1, 3.2, 3.3, 3.4)

TEXTBOOKS:

MAT112 VECTOR CALCULUS, FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS  3 1 0  4

Unit 1
Vector and scalar functions, derivatives, curves, tangents, arc Length, curves in mechanics, velocity and acceleration, gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field. (Sections: 8.4, 8.5, 8.6, 8.9, 8.10, 8.11)
Line integral, line integrals independent of path (Sections: 9.1, 9.2)

Unit 2
Green’s theorem in the plane, surfaces for surface integrals, surface integrals, triple integrals – Gauss divergence theorem, Stoke’s theorem. (Sections: 9.4, 9.5, 9.6, 9.7, 9.9)

Unit 3
Periodic functions, trigonometric series, Fourier series, functions of any period p = 2L, even and odd functions, half range expansions (theorem statement only), complex Fourier series, applications of Parseval’s identity. (Sections: 10.1 to 10.5)
Basic concepts, modeling; vibrating string, wave equation, separation of variables, use of Fourier series, d’Alembert’s solution of the wave equation, heat equation; solution by Fourier series. (Sections: 11.1 to 11.5)

TEXTBOOK:
conformal mapping, exponential function, trigonometric functions, hyperbolic functions, logarithms, general power, linear fractional transformation. (Sections: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8,12.9)

Unit 2
Complex line integral, Cauchy integral theorem, Cauchy integral formula, derivatives of analytic functions. (Sections: 13.1, 13.2, 13.3, 13.4.)

Power series, Taylor series and Maclaurin series. Laurent series, zeros and singularities, residues, Cauchy residue theorem, evaluation of real integrals using residue theorem. (Sections: 14.4, 15.1, 15.2, 15.3, 15.4)

Unit 3
Laplace transforms, inverse transforms, linearity, shifting, transforms of derivatives and Integrals, unit step function, second shifting theorem, Dirac's delta function. Differentiation and integration of transforms. Convolution, integral equations, partial fractions, differential equations, systems of differential equations. (Sections: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7)

Fourier integrals (Fourier integral theorem statement only), Fourier cosine and sine transforms, Fourier transforms. (Sections: 10.8 to 10.10)

TEXTBOOK:

MAT212 MATHEMATICAL STATISTICS AND NUMERICAL METHODS 3104

Unit 1
Probability, random variables, probability distributions (continuous and discrete), mean and variance of a distribution, expectation and moment generating functions, binomial, poisson and normal distributions, random sampling, estimation of parameters. (Sections: 22.3, 22.5, 22.6, 22.7, 22.8, 23.1, 23.2)

Unit 2
Confidence interval and central limit theorem, testing of hypothesis. (Sections: 23.3, 23.4)

Solution of equations by iterative methods, interpolation. (Sections: 17.2, 17.3)

Unit 3

TEXTBOOK:

MEC100 ENGINEERING MECHANICS 3104

Unit 1
Principles of statics: Introduction to vector approach – free body diagrams - forces in plane – forces in space - concurrent forces – resolution of forces - equilibrium of particle.

Statics of rigid bodies in two dimensions and three dimensions: Moment of a force about a point - moment of a force about an axis - moment of a couple – equivalent force - couple system - rigid body equilibrium – support reactions.

Unit 2

Centroid and centre of gravity: Centroids of lines, areas and volumes – composite bodies.

Second moment of area – polar moment of inertia - mass moment of inertia - radius of gyration.

Unit 3
Dynamics of particles: Kinematics of particles – rectilinear motion – relative motion - position, velocity and acceleration calculations in cylindrical coordinates.

Dynamics of rigid bodies: General plane motion - translation and rotation of rigid bodies – Chasle’s theorem – velocity and acceleration calculations in moving frames of references – Coriolis acceleration.

TEXTBOOKS:

REFERENCES:

MEC180 WORKSHOP A 1022

Product detailing workshop: (Study of simple mechanical and electromechanical system)

Disassemble the product or sub assembly – measure various dimensions using measuring instruments – free hand rough sketch of the assembly and components – name the components and indicate the various materials used – study the
functioning of the assembly and parts – study the assembly and components design for compactness, processing, ease of assembly and disassembly – assemble the product or subassembly.

**Pneumatics and PLC workshop:**

**Sheet metal workshop:**
Study of tools and equipment – draw development drawing of simple objects on sheet metal (cone, cylinder, pyramid, prism, tray, etc.) – fabrication of components using small shearing and bending machines – riveting and painting practice.

**Welding workshop:**
Study of tools and equipment – study of various welding methods – arc welding practice and demonstration of gas welding and cutting.

**Demolition and practice workshop:**

- **Fitting:** Study of tools, practice in chipping, filing and making joints.
- **Carpentry:** Study of tools, planning practice and making joints.

**REFERENCES:**
Concerned Workshop Manual

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**SYLLABI**

**MEC181 ENGINEERING DRAWING 1 0 3 2**


Orthographic projections – projection of points; projection of lines; projection of planes; projection of solids.

Section of solids; Intersection of solids; development of surfaces.

Orthographic views of three-dimensional solids.

Isometric projection.

**TEXTBOOK:**

**REFERENCES:**

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**SYLLABI**

**MEC182 COMPUTER AIDED DRAWING 1 0 3 2**

Introduction to CAD
Preparation of drawings using CAD Tools
Introduction to VBA / LISP
Introduction to 3D modeling and Surface Modeling

**TEXTBOOKS:**

**REFERENCES:**
Concerned Workshop Manual

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**MNG400 PRINCIPLES OF MANAGEMENT 3 0 0 3**

**Unit 1**

**HISTORICAL DEVELOPMENT:** definition of management – science or art – management and administration – development of management thought – contribution of Taylor and Fayol – functions of management – types of business organisations.


**Unit 2**


**Unit 3**

**Communication:** process of communication – barriers and breakdown – effective communication – electronic media in communication.

**CONTROLLING:** system and process of controlling – requirements for effective control – the budget as control technique – information technology in controlling – use of computers in handling the information – productivity – problems and management – control of overall performance – direct and preventive control – reporting – the global environment – globalization and liberalization – international management and global theory of management.
TEXTBOOKS:

REFERENCES BOOKS:

PHY100 PHYSICS

Unit 1
Special theory of relativity: Frames of reference, postulates of special theory of relativity, time dilation, length contraction, relativistic mass, relativistic momentum, mass and energy, Lorentz transformation, velocity addition, Doppler effect.
Physical background for quantum mechanics: Black body radiation, photoelectric effect, Compton effect, X-ray diffraction, pair production, de-Broglie waves, uncertainty principle.

Unit 2
Quantum mechanics: Wave function, wave equation, Schrödinger equation (time dependent), expectation values-operators, eigen functions and eigen values, Schrödinger equation (steady state), particle in a box-finite potential, tunneling effect, quantum theory of hydrogen atom.

Unit 3

TEXTBOOK:

REFERENCES:

PHY181 PHYSICS LAB.

1. Experiments on mechanics
   1. Torsional pendulum.
   2. Co-efficient of viscosity of liquid.
   3. Young’s modulus - non-uniform bending.

2. Experiments on optics
   1. Determination of lycopodium powder particle size using laser.
   2. Dispersive power of prism.

3. Experiments on electricity
   1. Meter bridge / energy gap.
   2. Frequency of AC current.
   3. Temperature co-efficient of resistance.

TEXTBOOK:
The manual for experiments prepared by the Department of Physics, AVVP. Experiments will be renewed as and when feasible.

REFERENCE:

PHY250 ELECTRICAL ENGINEERING MATERIALS

Unit 1
Conducting materials: The nature of chemical bond, crystal structure Ohm’s law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.
Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it’s consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2
Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous
magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti-ferromagnetic materials, ferrites and its applications.

Unit 3

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of the p-n junction rectifier, the n-p-n transistor.

TEXTBOOK:

REFERENCES:

PHY251 OPTOELECTRONIC DEVICES 3 0 0 3

Unit 1


Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence, electro luminescence, radioactive and non-radiative recombination, wave trains.

Unit 2

Semiconductor light-emitting diodes: Structure and types of LEDs and their characteristics, guided waves and optical modes, optical gain, confinement factor, internal and external efficiency, semiconductor heterojunctions, double-heterostructure LEDs.

Semiconductor lasers: Spontaneous and stimulated emission, principles of a laser diode, threshold current, effect of temperature, design of an edge-emitting diode, emission spectrum of a laser diode, quantum wells, quantum-well laser diodes.

Unit 3

Semiconductor light modulators: Modulating light (direct modulation of laser diodes, electro-optic modulation, acousto-optic modulation), isolating light (magneto-optic isolators), inducing optical nonlinearity (frequency conversion, switching).

REFERENCES:

TEXTBOOKS:

REFERENCES:

PHY253 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3

Unit 1

Electrostatics: Coulombs law and electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of sheet of charge, electric flux density, Gauss’s law, application of Gauss’s law, Maxwell’s first equation.

Poisson’s and Laplace’s equations: The potential field of a point charge, potential field of a system of charges : conservative property, potential gradient, the dipole.

Unit 2

Poisson’s and Laplace’s equations, uniqueness theorem, examples of the solution of Laplace’s equation, solution of Poisson’s equation.

Electromagnetics: Biot Savart law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, derivation of steady magnetic field laws, Faraday’s laws, displacement current, Maxwell’s equations in point and integral form, retarded potentials

Unit 3

Electromagnetic waves: EM wave motion in free space, wave motion in perfect dielectrics, plane wave in lossy dielectrics, Poynting vector and power consideration, skin effect, reflection of uniform plane waves, standing wave ratio. Transmission line equations, line parameters-examples, dipole radiation, retarded potentials, electric dipole radiation.

TEXTBOOK:

References:

PHY254 MICROELECTRONIC FABRICATION 3 0 0 3

Unit 1

Introduction to semiconductor fabrication – scaling trends of semiconductor devices; crystal structure of semiconductor materials, crystal defects, phase diagrams and solid solubility; physics of Czochralski growth of single crystal silicon, Bridgeman method for GaAs, float zone process; diffusion science: Ficks laws of diffusion, atomistic models of diffusion, dopant diffusion mechanisms; kinetics of thermal oxidation, Deal-Grove Model, nitridation of silicon, structure and characteristics of oxides, effect of dopants on oxidation kinetics, dopant redistribution;

Unit 2

Physics of ion implantation: Coulombic scattering and projected range, nuclear and electronic stopping, channeling, implantation damage removal, dopant activation by rapid thermal annealing; principles of optical lithography – optics and diffraction, light sources and spatial coherence, physics of pattern transfer, nodulation transfer function; chemistry of lithographic processes: organic and polymeric photoresists, developing and exposure, contrast; principles of non-optical lithography: electron beam, X-ray lithography, resists, sources;! etching: Chemistry of wet etching, plasma physics, chemistry of plasma etching and reactive ion etching; chemical mechanical polishing.

Unit 3

Vacuum science: Kinetic theory of gases, gas flow and conductance, vacuum pumps and seals; deposition of thin films: physics of sputtering and evaporation, step coverage and morphology of deposited films, chemical vapor deposition: chemical equilibrium and law of mass action, gas flow and boundary layers, types of CVD, plasma assisted CVD; thermodynamics of epitaxial growth, types molecular beam epitaxy, isolation and contact formation – LOCOS and trench, silicides, metallization with Al and Cu; process Integration: CMOS, bipolar process flow.

TEXTBOOK:
Stephen Campbell, Science and Engineering of Microelectronic Fabrication, Oxford University Press, 2001

References:
**PHY255**  
**ELECTRONIC MATERIALS SCIENCE**  
**3 0 0 3**  

Unit 1  
Types of bonding in solids, Crystallography and crystalline defects: Crystallography, Directions and planes, Crystalline defects, line defects, Planar defects, Volume defects; Binary and Ternary Phase Diagrams: Lever rule and phase rule, Eutectic, peritectic and Eutectoid systems, Applications of Phase diagrams; Basic Quantum Physics - atomic structure, Use of band theory and occupation statistics to explain existence and basic properties of metals and nonmetals. Working of Semiconductor Devices using band diagrams and their electrical characteristics: pn junctions, BJT, MOSFET.

Unit 2  
Use of band theory to explain optoelectronic properties of materials and optoelectronic devices: LEDs, Solar Cells, Lasers, pin diodes, photodiodes; Magnetic properties and Superconductivity: Magnetic moments and Magnetic Permeability, types of magnetism, saturation magnetization, magnetic domains, soft and hard magnetic materials, superconductivity and its origin, Giant Magneto Resistance, Josephson effect, Energy band diagrams and Magnetism, Applications of magnetic materials- Magnetic recording materials, etc.

Unit 3  

**TEXTBOOK:**  

**REFERENCE:**  

**PHY260**  
**PHYSICS OF LASERS AND APPLICATIONS**  
**3 0 0 3**  

Unit 1  
Review of some basic concepts and principle of laser.  

Unit 2  
**Properties of LASERS**  
Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of Dw FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity. Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3  
**Types of LASERS**  
Solid state LASER: (i) Ruby LASER – principle, construction, working and application. (ii) Neodymium (Nd) LASERS. gas LASER: (i) He-Ne LASER - principle, construction, working and application. (i) CO₂ LASER - principle, construction, working and application. Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.  
**Applications in Communication field:**  
LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication. Applications of LASERS in other fields:  

**REFERENCES:**  
Unit 1
Basic optical theory: Nature of electromagnetic radiation, interaction of radiation with matter, reflection, refraction, polarization, laser fundamentals, laser beam characteristics, beam quality (laser cavity modes), Q-switching, mode locking, continuous wave, types of lasers, energy and power.

Laser interaction with materials: Optical properties of materials, laser interaction with metals, insulators, semiconductors, polymers and biological materials.


Unit 2
Laser cutting and drilling: Mechanism for inert gas and oxygen-assisted cutting, factors controlling cut quality and kerf width. Laser assisted drilling.

Laser welding: Introduction to laser keyhole welding and contrast with conduction limited welding, applications.

Direct laser fabrication (DLF): Laser sintering & laser rapid manufacturing, comparison with rapid prototyping. Main potential and limitations of DLF for direct fabrication and for the production of novel engineering materials and structures.

Unit 3
Laser forming: Mechanisms involved, including thermal temperature gradient, buckling, upsetting. Applications in alignment and straightening and in rapid production processes.

Scope of application of laser materials processing: focused on industrial application of laser in materials processing including laser welded tailored blanks.

Laser safety: Introduction to safety procedures in the use of lasers, including wavelength effects and laser safety standards.

REFERENCES:
**PHY263 CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY  3 0 0 3**

**Unit 1**

**Introduction**

Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

**Concept of quantum confinement and phonon confinement**


**Unit 2**

**Tools for characterization:**


**Nanoscale materials – properties and applications:**

Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

**Unit 3**


**Nanoelectronics and nanodevices:**

Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

**TEXTBOOK:**


**REFERENCES:**


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**PHY264  THIN FILM PHYSICS  3 0 0 3**

**Unit 1**

**Introduction and preparation of thin film:** Difference between thin and thick film. Appreciation of thin film technology in modern era. Deposition technology: Physical methods, chemical methods, other new techniques, vacuum technology: Vacuum pumps & pressure gauges.

**Defects in thin film:** General concepts, nature of defect, microscopic defect and dislocation. Boundary defects. Defect and energy states - donar acceptor levels, trap and recombination centers, excitons, phonons.

**Unit 2**

**Thin film analysis:** Structural studies: XRD and electron diffraction. Surface studies: electron microscopy studies on film (SEM, TEM, AFM.) Film composition: X-ray photoelectron spectroscopy (XPS), Rutherford Back Scattering spectroscopy (RBS) and Secondary Ion Mass Spectroscopy (SIMS).

**Properties of thin film:** Optical behaviors: transmission, reflection, refractive index, photoconductivity, and photoluminescence.

**Unit 3**

Electrical behaviors: sheet resistivity, electron mobility and concentration, Hall effect, conduction in MIS structure.

**Applications of thin films in various fields:** Antireflection coating, FET, TFT, resistor, thermistor, capacitor, solar cell, and MEMs fabrication of silicon wafer: Introduction. preparation of the silicon wafer media, silicon wafer processing steps.

**TEXTBOOK:**


**REFERENCES:**

PHY270  MEDICAL PHYSICS  3 0 0 3

Unit 1
Ultrasonics - production methods and properties - acoustic impedance - Doppler velocimetry - echo cardiography - resolution - speckle - ultrasound imaging - therapeutic use of ultrasound - use in diagnostics of cardiac problems.

Unit 2
Nuclear medicine - principles of nuclear physics - natural radioactivity, decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Nuclear Isomerism, internal conversion - ideal energy for radiotherapy based on interactions. Radionuclide used in medicine - radionuclide production - dosimetry - safety - radiation hazards - PET.
Nuclear magnetic resonance physics - magnetic moment - magnetization - relaxation - nuclear magnetic resonance spectroscopy.

Unit 3
Nuclear magnetic resonance imaging (MRI) - principle - chemical shift - magnetic resonance signal induction and relaxation - pulse sequencing and spatial encoding.

TEXTBOOK:

REFERENCE BOOKS
1. Glasser.O. Medical Physics Vol.1, 2, 3 Book Publisher Inc Chicago, 1980

PHY271  ADVANCED CLASSICAL DYNAMICS  3 0 0 3

Unit 1
Introduction to Lagrangian dynamics
Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D’Alembert’s principle and Lagrange’s equation, simple applications of the Lagrangian formulation, variational principles and Lagrange’s equations, Hamilton’s principles, derivation of Lagrange’s equations from Hamilton’s principle, conservation theorems and symmetry properties.
Einstein coefficients and light amplification - stimulated emission - optical pumping and laser action.

Unit 3: Operation of He-Ne laser and Ruby laser - laser in science and industry - Raman effect and applications.

Nuclear physics: nuclear properties - binding energy and mass formula - nuclear decay with applications - theory of alpha decay - nuclear forces - fission - principle of nuclear reactor - elementary particles - leptons, hadrons, quarks, field bosons - the standard model of elementary particles.

TEXTBOOK:
A Beiser, Perspectives in Modern Physics, Mc Graw Hill

REFERENCES:

PHY273 COMPUTATIONAL PHYSICS 3 0 0 3

Unit 1: Differentiation: Numerical methods, forward difference and central difference methods, Lagrange's interpolation method.
Integration: Newton - cotes expression for integral, trapezoidal rule, Simpson's rule, Simpson's rule, Gauss quadrature method.


Eigen values and Eigen vectors of matrix: Determinant of a matrix, characteristic equation of a matrix, eigen values and eigen vectors of a matrix, power method.

TEXTBOOK:
Rubin H Landau & Manuel Jose Paez Mejia, “Computational Physics”, John Wiley & Sons

REFERENCES:
2. M Hijroth Jensen, Department of Physics, University of Oslo, 2003 (Available in the Web)

PHY274 ASTROPHYSICS 3 0 0 3

Unit 1: Historical introduction: Old Indian and western - astronomy - Aryabhatta, Tycho Brahe, Copernicus, Galileo - Olbers paradox - solar system - satellites, planets, comets, meteorites, asteroids.
Practical astronomy - telescopes and observations & techniques - constellations, celestial coordinates, ephemeris.
Celestial mechanics - Kepler's laws - and derivations from Newton's laws.
Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

Unit 3: Galactic astronomy: Distance measurement - red shifts and Hubble's law - age of the universe, galaxies - morphology - Hubble's classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.
Cosmology: Comic principles, big bang and big crunch - cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

REFERENCES:
5. 'Stellar Astronomy’ by K.D Abhayankar.

SSK111  SOFT SKILLS I  0 0 3 1

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self-confidence: Characteristics of the person perceived, characteristics of the situation, characteristics of the perceiver. Attitude, values, motivation, emotion management, steps to like yourself, positive mental attitude, assertiveness.

Presentations: Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy, etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words. Listening skills: The importance of listening in communication and how to listen actively.

Prepositions, articles and punctuation: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving level – I: Number system; LCM & HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;

Problem solving level – II: Time speed and distance; work time problems;

Data interpretation: Numerical data tables; Line graphs; Bar charts and Pie charts; Caselet forms; Mix diagrams; Geometrical diagrams and other forms of data representation.

Logical reasoning: Family tree; Deductions; Logical connectives; Binary logic; Linear arrangements; Circular and complex arrangement; Conditionalities and grouping; Sequencing and scheduling; Selections; Networks; Codes; Cubes; Venn diagram in logical reasoning; Quant based reasoning; Flaw detection; Puzzles; Cryptarithms.

SYLLABI  B. Tech. - Civil Engg.  2010 admissions onwards

TEXTBOOKS:
6. Quantitative Aptitude – Abijith Guha, TMH.
7. Quantitative Aptitude for Cat- Arun Sharma. TMH.

REFERENCES:
3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources
www.the grammarbook.com online teaching resources
www.englishpage.com online teaching resources and other useful websites.

SSK112  SOFT SKILLS II  0 0 3 1


Telephone etiquette: activities during the conversation, conclude the call, to take a message. Body Language: Components, undesirable body language, desirable body language. Adapting to corporate life: Dealing with people.

Group discussions: Advantages of group discussions, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques.

Listening comprehension advanced: Exercise on improving listening skills, grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving level – III: Money related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series; Set theory; Permutations and combinations; Probability; Statistics.

Data sufficiency: Concepts and problem solving.
Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous.

Spatial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

TEXTBOOKS:
5. Quick Math – Tyra.
6. Quicker Arithmetic – Ashish Aggarwal
7. Test of reasoning for competitive examinations by Thorp.E. TMH
8. Non-verbal reasoning by R.S. Aggarwal, S. Chand

REFERENCES:
3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources www.the grammarbook.com online teaching resources
www.englishpage.com online teaching resources and other useful websites.

Team work: Value of team work in organisations, definition of a team, why team, elements of leadership, disadvantages of a team, stages of team formation. Group development activities: Orientation, internal problem solving, growth and productivity, evaluation and control. Effective team building: Basics of team building, teamwork parameters, roles, empowerment, communication, effective team working, team effectiveness criteria, common characteristics of effective teams, factors affecting team effectiveness, personal characteristics of members, team structure, team process, team outcomes.

Facing an interview: Foundation in core subject, industry orientation/knowledge about the company, professional personality, communication skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.