Electives 1
Syllabus for B.Tech in Civil Engineering

Course: Remote Sensing Techniques and GIS			Semester: V
Course Code: CET 3111	L T P	3 0 0	Credits: 3

Objective: To introduce students to the knowledge of remote sensing, its components and features used and the concepts of geographical information system (GIS) with its applications.

Syllabus

Remote Sensing and GIS **8**

Remote sensing: aerospace images, aerial photography and satellite images, geographic information system (GIS) concepts and terminology, utility of GIS, essential components of a GIS, hardware and software requirements for GIS, conceptual models in GIS, data acquisition: scanners and digitizers, method of digitization, data storage, verification and editing, remote sensing data as input to GIS.

Data Models **8**

Data Types: spatial data and non-spatial data, spatial data models: raster data model and vector data model, data formats, raster vector data conversion, data compression, run length coding, quadtree tessellation, point line and area features, topology, data reduction and generalization, map projection and transformation, geo-referencing, edge matching, rectification and registration data quality and sources of errors.

Spatial and Non Spatial Data **8**

Non spatial data, database structure: hierarchical database structure, network data structure, relational database structure, data storage and retrieval in GIS, object oriented database, database management System.

Spatial Data Manipulation and Analysis **10**

Spatial data manipulation and analysis: reclassification and aggregation, geometric and spatial operations on data, layers, coverage, overlays, buffers, measurement and statistical modeling, raster based analysis, vector based analysis, network analysis, data output: types of output.

Applications of GIS **10**

Applications of GIS in administration, planning, management, monitoring, engineering, digital elevation model (DEM) and other areas, various GIS packages and their salient features, modern trends: web GIS, open GIS, data mining, GIS customization, automated mapping/facilities management (AM/FM).

Suggested Readings

1. Burrough, P.A. and McDonnell, R.A.," *Principles of Geographic Information System"*, Oxford University Press.
2. Chandra, A.M. and Ghosh, S.K.," *Remote Sensing and Geographical Information Systems"*, Narosa Publishing House, New Delhi.
3. *Manual of Remote Sensing, Vol.2*, "American Society of Photogrammetry & Remote Sensing".
4. Aromoff S.,*"Geographic Information Systems: A Management Perspective"*, WDL Publications.

Course: Ground Improvement Techniques			Semester: V
Course Code: CET 3112	L T P	3 0 0	Credits: 3

Objective: To develop skills to identify the problematic soil and suitable suggest remedial measures to improve their behaviour.

Syllabus

Problematic Soil and Improvement Techniques **8**

Role of ground improvement in foundation engineering, methods of ground improvement, geotechnical problems in alluvial, lateritic and black cotton soils, selection of suitable ground improvement techniques based on soil conditions.

Dewatering **10**

Dewatering techniques, well points, vacuum and electro-osmotic methods, seepage analysis for two, dimensional flow for fully and partially penetrated slots in homogeneous deposits, simple cases, design.

In-situ Treatment of Cohesionless and Cohesive Soils **10**

In-situ densification of cohesion-less soils and consolidation of cohesive soils: dynamic compaction vibroflotation, sand compaction piles and deep compaction, consolidation: preloading with sand drains, and fabric drains, stone columns and lime piles-installation techniques- simple design, relative merits of above methods and their limitations.

Earth Reinforcement **9**

Concept of reinforcement, types of reinforcement material, reinforced earth wall, mechanism, simple design, applications of reinforced earth, role of geotextiles in filtration, drainage, separation, road works and containment.

Grout Techniques **8**

Types of grouts, grouting equipments and machinery, injection methods, grout monitoring, stabilization with cement, lime and chemicals, stabilization of expansive soil.

Suggested Readings

1. Purushothama Raj. P, *"Ground Improvement Techniques"*, Firewall Media, 2005
2. Koerner, R.M. *"Construction and Geotechnical Methods in Foundation Engineering"*, McGraw Hill, 1994.
3. Mittal.S, *"An Introduction to Ground Improvement Engineering"*, Medtech Publisher, 2013.
4. Moseley, M.P., *"Ground Improvement Blockie Academic and Professional"*, Chapman and Hall, Glasgow, 1998.
5. Jones J.E.P. *"Earth Reinforcement and Soil Structure"*, Butterworths, London, 1985.
6. Winterkorn, H.F. and Fang, H.Y. *"Foundation Engineering Hand Book"*. Van Nostrand Reinhold, 1994.
7. Das, B.M. *"Principles of Foundation Engineering"* 7th edition, Cengage learning, 2010.
8. IS15284 (Part 1): 2003 *"Design and Construction for Ground Improvement – Guidelines"* (Stone Column), Bureau of Indian Standards, New Delhi, 2003.

Course: Natural Disaster and Management			Semester: V
Course Code: CET 3113	L T P	3 0 0	Credits: 3

Objective: To provide students an exposure to disasters, their significance and types to ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.

Syllabus

Introduction to Disasters **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

Approaches to Disaster Risk Reduction (DRR) **9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

Inter-Relationship between Disasters and Development **9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

Disaster Risk Management in India **9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, and Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment

Disaster Management: Applications and Case Studies and Field Works **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

Suggested Readings

1. Singhal J.P. "*Disaster Management*", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "*Disaster Science and Management*", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. *Environmental Knowledge for Disaster Risk Management*, NIDM, New Delhi, 2011
4. Kapur Anu *Vulnerable India: A Geographical Study of Disasters*, IIAS and Sage Publishers, New Delhi, 2010.
5. *Govt. of India: Disaster Management Act* , Government of India, New Delhi, 2005
6. *Government of India, National Disaster Management Policy*, 2009.

Course: Repair and Rehabilitation of Structures			Semester: V
Course Code: CET 3114	L T P	3 0 0	Credits: 3

Objective: To introduce students to the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

Syllabus

Maintenance and Repair Strategies **9**

Maintenance, repair and rehabilitation, facets of maintenance, importance of maintenance, various aspects of inspection, assessment procedure for evaluating a damaged structure, causes of deterioration.

Strength and Durability of Concrete **9**

Quality assurance for concrete, strength, durability and thermal properties of concrete, different types of crack, causes, effects due to climate, temperature, sustained elevated temperature, corrosion, effects of cover thickness

Special Concretes **9**

Polymer concrete, sulphur infiltrated concrete, fibre reinforced concrete, high strength concrete, high performance concrete, vacuum concrete, self compacting concrete, geopolymer concrete, reactive powder concrete, concrete made with industrial wastes.

Techniques for Repair and Protection Methods **9**

Non-destructive testing techniques, epoxy injection, shoring, underpinning, corrosion protection techniques, corrosion inhibitors, corrosion resistant steels, coatings to reinforcement, cathodic protection.

Retrofitting of Structures **6**

Strengthening of structural elements, repair of structures distressed due to corrosion, fire, leakage, earthquake, demolition techniques, engineered demolition methods, case studies.

Suggested Readings

1. Denison Campbell, Allen and Harold Roper, "*Concrete Structures, Materials, Maintenance and Repair*", Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, *Repair of Concrete Structures*, Blakie and Sons, UK, 1987
3. Shetty M.S., "*Concrete Technology, Theory and Practice*", S. Chand and Company, 2014.
4. Dov Kominetzky. M. S., "*Design and Construction Failures*", Galgotia Publications Pvt. Ltd., 2001.
5. Ravishankar. K., Krishnamoorthy. T. S, "*Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures*", Allied Publishers, 2004.
6. CPWD and Indian Buildings Congress, *Hand book on Seismic Retrofit of Buildings*, Narosa Publishers, 2008.
7. Gambhir M. L., "*Concrete Technology*", McGraw Hill, 2013.

Course: Advanced Structural Analysis			Semester: V
Course Code: CET 3115	L T P	3 0 0	Credits: 3

Objective: To develop skills to analyze internal forces in members of complex structures with the help of matrix and standard software packages.

Syllabus

Review of Basic Concepts in Structural Analysis **9**

Force methods: statically indeterminate structures (method of consistent deformations, theorem of least work), displacement methods: kinematically indeterminate structures (slope-deflection method, moment distribution method).

Matrix Concepts and Matrix Analysis of Structures **6**

Matrix, vector, basic matrix operations, rank, solution of linear simultaneous equations, Eigen values and Eigen vectors, introduction, coordinate systems, displacement and force transformation matrices, contra-gradient principle, element and structure stiffness matrices, element and structure flexibility matrices, equivalent joint loads, stiffness and flexibility approach.

Matrix Analysis of Structures with Axial Elements **8**

Introduction: axial stiffness and flexibility, stiffness matrices for an axial element (two DOF), plane truss element (four DOF) and space truss element (six DOF), one-dimensional axial structures: analysis by conventional stiffness method (two DOF per element) and reduced element stiffness method (single DOF),analysis by flexibility method, plane trusses: analysis by conventional stiffness method (four DOF per element) and reduced element stiffness method (single DOF), analysis by flexibility method, space trusses: analysis by conventional stiffness method (six DOF per element) and reduced element stiffness method (single DOF).

Matrix Analysis of Beams and Grids **10**

Conventional stiffness method for beams: beam element stiffness (four DOF), generation of stiffness matrix for continuous beam, dealing with internal hinges, hinged and guided-fixed end supports, accounting for shear deformations, reduced stiffness method for beams: beam element stiffness (two DOF), dealing with moment releases, hinged and guided-fixed end supports, flexibility method for fixed and continuous beams: force transformation matrix, element flexibility matrix, solution procedure 10 flexibility matrix, solution procedure (including support movements), stiffness method for grids: introduction, torsional stiffness of grid element and advantage of torsion release, analysis by conventional stiffness method using grid element with six DOF, analysis by reduced stiffness method (three DOF per element).

Matrix Analysis of Plane and Space Frames **7**

Conventional stiffness method for plane frames: element stiffness (six DOF), generation of structure stiffness matrix and solution procedure, dealing with internal hinges and various end conditions, reduced stiffness method for plane frames: element stiffness (three DOF), ignoring axial deformations, dealing with moment releases, hinged and guided fixed end supports, flexibility method for plane frames: force transformation matrix, element flexibility matrix, solution procedure (including support movements), ignoring axial deformations, stiffness method for space frames: introduction, element stiffness matrix of space frame element with 12 DOF and 6 DOF, coordinate transformations, analysis by reduced stiffness method (six DOF per element).

Analysis of Elastic Instability and Second-Order Effects **7**

Effects of axial force on flexural stiffness, measures for beam-columns - braced and unbraced, under axial compression, solution by slope deflection method: slope deflection equations for prismatic beam columns using stability functions, modifications for pinned and guided-fixed-end conditions, fixed end moments in beam-columns, solution by matrix method: stiffness matrix for prismatic beam, second-order analysis

Suggested Readings

1. Devdas Menon, "*Advanced Structural Analysis*", Narosa Publishing House, 2009
2. Asslam Kassimali, "*Matrix Analysis of Structures*", Brooks/Cole Publishing Co., USA, 1999.
3. Amin Ghali, Adam M Neville and Tom G Brown, "*Structural Analysis: A Unified Classical and Matrix Approach*", Sixth Edition, 2007, Chapman & Hall.
4. Devdas Menon, "*Structural Analysis*", Narosa Publishing House, 2008.

Course: **Port, Harbour and Tunneling Engineering**			**Semester: V**
Course Code: CET 3116	**L T P**	**3 0 0**	**Credits**: **3**

Objective: To impart the knowledge of classification and planning of ports, harbours, docks and tunnels.

Syllabus

Harbours and Ports **15**

Introduction, water transportation, classification of harbours, site selection, shape of harbour, harbour depth, marine surveys, harbour planning, defects in harbours, requirements of good harbour, general, littoral drift, sea water waves, tide generation, lunar tides, solar tides, tides due to moon and sun, total number of tides, effect of tides, general, classification of breakwaters, heap or mound breakwater, selection of type of break water, details of energy dissipation in mound break water, characteristics of mound break water, rubble mound breakwater

Docks **10**

Introduction, classification of docks, classification of wet docks, advantages and disadvantages of tidal wet docks, advantages and disadvantages of enclosed wet docks, form and arrangement of basins and docks, design loads, other aspects of construction details, dock entrances, sizes of dock entrances.

Tunnels **15**

Sections of tunnels: advantages, limitations and suitability of each section, shaft, pilot tunnel, driving tunnel in rocks: sequence of construction operations, full face method, heading and bench method, drift method, driving tunnels in soft ground: sequence of construction operations, needle beam method, shield tunneling, compressed air tunneling.

Suggested Readings

1. Oza H. P. and Oza G. H., "*Dock and harbour engineering*", Charotar Publishing House Pvt. Ltd 6th Edition 2011
2. Bindra S.P., *"A course in docks and harbour engineering",* Dhanpat Rai Publication 1992.
3. Srinivasan R., *"Harbour Dock and Tunnel Engineering",* Charotar Publishing House Pvt. Ltd., 25th Edition 2012
4. Saxena S. C., "*Tunnel Engineering"*, Dhanpat Rai Publications, N. Delhi.

Course: Engineering Geology			Semester: V
Course Code: CET 3117	L T P	3 0 0	Credits: 3

Objective: To understand the importance of geological knowledge of earth, earthquake, volcanism in projects such as dams, tunnels, bridges, roads, airport and harbor.

Syllabus

Physical Geology **8**

Geology in civil engineering, branches of geology, structure of earth and its composition, weathering of rocks, scale of weathering, soils, landforms and processes associated with river, wind, groundwater and sea, relevance to civil engineering, plate tectonics, earth quakes, seismic zones in India.

Mineralogy **8**

Physical properties of minerals, quartz group, feldspar group, pyroxene, hypersthene and augite, amphibole, hornblende, mica, muscovite and biotite, calcite, gypsum and clay minerals.

Petrology **8**

Classification of rocks, distinction between igneous, sedimentary and metamorphic rocks, engineering properties of rocks, description, occurrence, engineering properties, distribution and uses of granite, dolerite, basalt, sandstone, limestone, laterite, shale, quartzite, marble, slate, gneiss and schist.

Structural Geology and Geophysical Methods **8**

Geological maps, attitude of beds, study of structures, folds, faults and joints, relevance to civil engineering, Geophysical methods, Seismic and electrical methods for subsurface investigations.

Application of Geological Investigations **8**

Remote sensing for civil engineering applications; geological conditions necessary for design and construction of dams, reservoirs, tunnels, and road cuttings, hydro-geological investigations and mining, coastal protection structures, investigation of landslides, causes and mitigation.

Improvement of Foundation Rocks **3**

Precaution and treatment against faults, joints and ground water, retaining walls and other precautions

Suggested Readings

1. Varghese P.C., *Engineering Geology for Civil Engineering*, Prentice Hall of India Learning Private Limited, New Delhi, 2012
2. Venkat Reddy D., *Engineering Geology*, Vikas Publishing House Pvt. Lt, 2010
3. Gokhale KVGK, *Principles of Engineering Geology*, B.S. Publications, Hyderabad 2011
4. Muthiayya V.D., *A Text of Geology*, Oxford IBH Publications, Calcutta, 1969
5. Blyth F.G.H. and de Freitas M.H., *Geology for Engineers*, Edward Arnold, London, 2010
6. Bell F.G., *Fundamentals of Engineering Geology*, B.S. Publications. Hyderabad 2011
7. Dobrin M.B., *An introduction to geophysical prospecting*, McGraw Hill, New Delhi, 1988

Electives 2
Syllabus for B.Tech in Civil Engineering

Course: Environmental Impact Assessment			Semester: VI
Course Code: CET 3211	L T P	3 0 0	Credits: 3

Objective: To familiarize students with the methods of risk assessment due to any existing or proposed project.

Syllabus

Introduction **8**

Introduction: impact of development projects under civil engineering on environment, environmental impact assessment (EIA), environmental impact statement (EIS), EIA capability and limitations, legal provisions on EIA.

Methodology **8**

Methods of EIA, check lists, matrices, networks, cost-benefit analysis, analysis of alternatives.

Prediction and Assessment **8**

Assessment of impact on land, water and air, noise, social, cultural flora and fauna; mathematical models; public participation, rapid EIA

Environmental Management Plan **9**

Plan for mitigation of adverse impact on environment, options for mitigation of impact on water, air and land, flora and fauna; addressing the issues related to the project affected people, ISO14000.

Case Studies **9**

EIA for infrastructure projects, bridges, stadium, highways, dams, multi-storey buildings, water supply and drainage projects, waste water treatment plants

Suggested Readings

1. Canter R.L., *Environmental Impact Assessment*, McGraw-Hill Inc., New Delhi, 1996.
2. Shukla S.K. and Srivastava P.R., *Concepts in Environmental Impact Analysis*, Common Wealth Publishers, New Delhi, 1992.
3. John G. Rau and David C Hooten (Ed), *Environmental Impact Analysis Handbook*, McGraw-Hill Book Company, 1990.
4. Environmental Assessment Source book, Vol. I, II & III. The World Bank, Washington, D.C., 1991.
5. Judith Petts, *Handbook of Environmental Impact Assessment* Vol. I & II, Blackwell Science, 1999.

Course: Soil Dynamics and Machine Foundations			Semester: VI
Course Code: CET 3212	L T P	3 0 0	Credits: 3

Objective: To impart to students the basic knowledge in theory of vibrations and behaviour of soils under dynamic loads so that foundations for various types of machines could be designed.

Syllabus

Vibrations **10**

Theory of vibrations, single, two and multiple degree of freedom systems, vibration isolation, vibration absorbers, vibration measuring instruments

Soil Properties **12**

Strength characteristics, factors affecting, philosophy of design of equipments, studies by dynamic tri-axial and oscillatory shear equipments, liquefaction, mechanism, factors affecting, studies by dynamic tri-axial testing, oscillatory shear box, shake table and blast tests, assessment of liquefaction potential

Load Analysis **6**

Dynamic earth pressure, analytical and graphical methods, displacement analysis of retaining walls, seismic stability of slopes: modified Swedish circle and Taylor's method, concept of yield acceleration and evaluation of displacement of embankment

Foundations **6**

Machine foundations, types and basic requirements, analysis and design of foundations for reciprocating and impact type machines, introduction to the design of T.G. foundations

Dynamic Elastic Constants **8**

Determination of dynamic elastic constants, various methods including block resonance tests, cyclic plate load tests, wave propagation tests, oscillatory shear box test, soil liquefaction test

Suggested Readings

1. Saran, S., "*Soil Dynamics and Machine Foundations*", Galgotia.
2. Kameswara Rao, N.S.V., "*Vibration Analysis and Foundation Dynamics*", Wheeler.
3. Das, B.M., "*Fundamentals of Soil Dynamics*", Elsevier.
4. Steven Kramer, "*Geotechnical Earthquake Engineering*", Pearson.
5. Prakash, S., "*Soil Dynamics*", McGraw Hill.

Course: Earthquake and Geotechnical Engineering			Semester: VI
Course Code: CET 3213	L T P	3 0 0	Credits: 3

Objective: To develop skills to estimate dynamic properties of soils affecting the design of substructures on seismic zones.

Syllabus

Seismology and Earthquakes **7**

Internal structure of the earth, continental drift and plate tectonics, faults, elastic rebound theory, different sources of seismic activity, geometric notation, location of earthquakes, size of earthquakes

Dynamic Properties of Soils **11**

Measurement of dynamic properties of soils, field tests, low strain, seismic reflection, horizontal layering, steady state vibration, spectral analysis of surface wave, seismic cross hole, down hole, up hole, tests, laboratory tests, resonance column test, bender element, cyclic tri-axial test.

Seismic Hazard Analysis **9**

Identification and evaluation of earthquake sources, geologic evidence, tectonic evidence, historical seismicity, instrumental seismicity, deterministic seismic hazard analysis, probabilistic seismic hazard analysis

Ground Response Analysis **9**

Ground response analysis, one dimensional linear, evaluation of transfer function, uniform undamped soil on rigid rock, uniform damped soil on rigid rock, uniform damped soil on elastic rock, layered damped soil on elastic rock, equivalent linear approximation, deconvolution.

Liquefaction Analysis **9**

Liquefaction, flow liquefaction, cyclic mobility, evaluation of liquefaction hazards, liquefaction susceptibility, criteria, historical geologic, compositional, state, evaluation of initiation of liquefaction, cyclic stress approach, characterization of liquefaction resistance, SPT test, various correction factor, factor of safety.

Suggested Readings

1. Krammer S.L., "*Geotechnical Earthquake Engineering*", Prentice Hall, International Series, Pearson Education Inc and Donling Kindersley Publishing Inc. 2013.
2. Roberto Villaverde, "*Fundamental Concepts of Earthquake Engineering*", CRC Press Taylor & Francis Group, 2009.
3. Kameswara Rao N.S.V., "*Dynamics soil tests and applications*", Wheeler Publishing, New Delhi, 2000.
4. Kameswara Rao., "*Vibration Analysis and Foundation Dynamics*", Wheeler Publishing, New Delhi, 1998.
5. McGuire R.K. "*Seismic Hazard and Risk Analysis Earthquake Engineering*" Research Institute, 2004.
6. IS15284 (Part 1): 2003 "*Design and Construction for Ground Improvement, Guidelines*" (Stone Column), Bureau of Indian Standards, New Delhi, 2003.

Course: Industrial Waste Management			Semester: VI
Course Code: CET 3214	L T P	3 0 0	Credits: 3

Objective: To give an idea of the different wastes which are produced in industries, its physical and chemical characteristics, impacts on environment and its treatment processes.

Syllabus

Introduction **8**

Types of industries and industrial pollution, characteristics of industrial wastes, population equivalent, bioassay studies, effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health, environmental legislations related to prevention and control of industrial effluents and hazardous wastes

Waste Management **8**

Waste management approach, waste audit, volume and strength reduction, material and process modifications, recycle, reuse and byproduct recovery, applications.

Industrial Pollution and Industrial Waste **9**

Sources, characteristics, waste treatment flow sheets for selected industries such as textiles, tanneries, pharmaceuticals, electroplating industries, dairy, sugar, paper, distilleries, steel plants, refineries, fertilizer, thermal power plants, wastewater reclamation concepts.

Industrial Waste Treatment Processes **10**

Different techniques involved: equalization, neutralization, removal of suspended and dissolved organic solids, chemical oxidation, adsorption, removal of dissolved inorganic, combined treatment of industrial and municipal wastes, residue management, dewatering, disposal.

Hazardous Waste Management **9**

Hazardous wastes, physico-chemical treatment, solidification, incineration, secure landfills.

Suggested Readings

1. Rao M. N. & Dutta A. K., "*Wastewater Treatment"*, Oxford - IBH Publication, 1995.
2. Eckenfelder W W. Jr., "*Industrial Water Pollution Control"*, McGraw-Hill Book Company, New Delhi, 2000.
3. Shen T. T., "*Industrial Pollution Prevention"*, Springer, 1999.
4. Stephenson R. L. and Blackburn J. B., Jr., "*Industrial Wastewater Systems Hand book"*, Lewis Publisher, New York, 1998.
5. Freeman H. M., "*Industrial Pollution Prevention Hand Book"*, McGraw-Hill Inc., New Delhi, 1995.
6. Bishop, P. L., "*Pollution Prevention: Fundamental & Practice"*, McGraw-Hill, 2000.

Course: Road Traffic Safety			Semester: VI
Course Code: CET 3215	L T P	3 0 0	Credits: 3

Objective: To introduce the concepts of traffic safety on highways and to make students familiar with related analytical methods and remedial measures.

Syllabus

Introduction **6**

Road traffic accidents scenario in India, characteristics of accidents, accident vs. crash, effect of human factors, planning for road network, land use and road environment for safety, designing for road safety – links and junctions, road safety engineering, road safety improvement strategies, elements of a road safety plan.

Crash Investigation and Analysis **8**

Steps in treatment of crash locations, diagnosing crash problem and solutions, accident report form, storing of data, using and interpreting crash data, identifying and prioritizing hazardous locations, condition and collision diagrams, vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled, crash reconstruction: understanding basic physics, calculation of speed for various skid, friction, drag, and acceleration scenarios.

Statistical Analysis of Accidents **8**

Descriptive statistics, confidence interval, hypothesis testing, models related to accident frequency, accident severity, accident duration, various methodological issues – over/under dispersion, time-varying explanatory variables, unobserved heterogeneity, endogeneity, under-reporting, spatial and temporal correlation, etc., accident prediction model

Before - After Methods in Crash Analysis & Economic Analysis of Accidents **8**

Before and after study, before and after study with control sites, comparative parallel study, before, during and after study, empirical bayes method, economic analysis of accidents: accident costing-economic appraisal, EUAC, PWOC, B/C ratio, IRR, NPV.

Traffic Management System & Road Safety Audits **12**

Traffic flow improvements, expressway patrol, public transit, ridesharing, mobility rest areas, park-and-ride lots, bus bays, signage, markings; its applications - vehicular navigation, crash avoidance system, incident management, traffic management centre, highway side communication. road safety audits: procedure, aims and objectives, roles and responsibility, history of road safety audit, design standards, tasks, various stages of safety audits; common identifiable problems, structuring of report, identifying common problems.

Suggested Readings

1. American Association of State Highway and Transportation Officials (AASHTO), *Highway Safety Manual*, 1st Edition, AASHTO.
2. Simon P. Washington, Matthew G. Karlaftis, Fred L. Mannering, Statistical and Econometric Method for Transportation Data Analysis, 2nd Edition, Chapman & Hall/CRC Press.
3. Ezra Hauer, *Observational Before -After Studies in Road Safety*, Pergamon Press.
4. Indian Roads Congress, *Highway Safety Code*, IRC: SP-44:1996.
5. Indian Roads Congress, Road Safety Audit Manual, IRC:SP-88-2010.
6. Limpert, Rudolf, Motor Vehicle Accident Reconstruction and Cause Analysis, 5th Edition, Lexas Publishing, Charlottesville, VA.

Course: Urban Planning			Semester: VI
Course Code: CET 3216	L T P	3 0 0	Credits: 3

Objective: To understand the basic principles of town planning techniques and implementation including zoning slum redevelopment, etc.

Syllabus

History of Town Planning **8**

Principles of town planning, town planning in ancient India, Indus Valley civilisation, objects and necessity of town planning, growth of towns, forms of cities, site for an ideal town, planning of modern town, medieval town, industrialisation and its effects on town planning.

Planning techniques and its implementation **8**

Basic methods of various types of surveys, collection of data, Methods adopted to collect data, standards for development and redevelopment of residential commercial industrial and re-creational areas, land use planning, socio economic data for urban planning.

Master plan and Zoning **8**

Master plan objects and necessity, stages in preparation of master plan, principles of zoning, objects and importance of zoning, Aspects, uses and economy of zoning, site for buildings, requirements of residential buildings classification of residential buildings, design of residential areas.

Slum and re-development of existing towns **8**

Slum: Causes, growth, characteristics, effects, slum clearance and re-housing, preventation of slum formation, financial assistance for slum clearance, objects of re-planning, defects of existing terms, urban renewal projects.

Housing **8**

Housing policy, different types of housing Agencies involved in housing, affordability of housing, infrastructure available in housing, different categories of houses as per HUDCO norms.

Suggested Readings

1. Biswas Hiranmoy, "Principles *of Town Planning and Architecture*", VAYU Education of India; First edition (2012)
2. Hiraskar G. K. , "*Fundamental of Town Planning*", Dhanpat Rai Publications (2012)
3. Rangawala, "*Town Planning*", Charotar Publishing House pvt. Ltd.; 28 edition (2015)
4. Faia Arthur B. Gallion, "*The Urban Pattern City Planning and Design*", CBS; 5th edition (2003)

Course: Foundation Engineering			Semester: VI
Course Code: CET 3217	L T P	3 0 0	Credits: 3

Objective: To impart knowledge on common method of sub soil investigation and design of a suitable foundation.

Syllabus

Site Investigation and Selection of Foundation **9**

Scope and objectives, methods of exploration, auguring and boring, wash boring and rotary drilling, depth of boring, spacing of bore hole, sampling techniques, representative and undisturbed sampling, methods, split spoon sampler, thin wall sampler, stationery piston sampler, penetration tests (SPT and SCPT), bore log report, data interpretation, strength parameters and liquefaction potential, selection of foundation based on soil condition, soil investigation report.

Earth Pressure Theory and Retaining Structures **9**

Introduction, limit equilibrium method, $\varphi_u = 0$ & C-φ analysis, earth dam slope stability with case study, types of earth pressures, different theories of earth pressures, displacement- related earth pressure, Rankine and Coulomb theory, introduction of retaining structure, different types of retaining structures, design considerations for retaining walls.

Shallow Foundations **9**

Introduction, location and depth of foundation, codal provisions, bearing capacity of shallow foundation on homogeneous deposits, Terzaghi's formula and BIS formula, factors affecting bearing capacity, problems, bearing capacity from in-situ tests (SPT, SCPT and plate load) allowable bearing pressure, seismic considerations in bearing capacity evaluation, determination of settlement of foundations on granular and clay deposits, total and differential settlement, allowable settlements, codal provision, methods of minimizing total and differential settlements.

Footings and Rafts **6**

Types of footings, contact pressure distribution: isolated footing, combined footings, types and proportioning, mat foundation, types and applications, proportioning, floating foundation, seismic force consideration, codal provision.

Pile Foundations **9**

Types of piles and their function, factors influencing the selection of pile, carrying capacity of single pile in granular and cohesive soil, static formula, dynamic formulae (engineering news and Hileys), capacity from in-situ tests (SPT and SCPT), negative skin friction, uplift capacity, group capacity by different methods (Felds rule, converse, Labarra formula and block failure criterion), settlement of pile groups, interpretation of pile load test (routine test only), under reamed piles, capacity under compression and uplift, case Study.

Well and Machine Foundations **3**

Introduction, Forces on well and its stability, Terminology, Degrees of freedom of Block Foundation, Free and forced vibration.

Suggested Readings

1. Arora K.R., *"Soil Mechanics and foundation engineering*", Standard publishers, Distributors, 5th Edition, 2000.
2. Ranjan G. T. and Rao A. S. R., "*Basic and Applied Soil Mechanics",* New Age International Publishers, 2nd Edition, 2000.
3. Venkataramaiah C., "*Geotechnical Engineering*", new age international publishers, Revised 3 rd Edition.
4. Das M. Braja, "*Fundamentals of Geotechnical Engineering*", Cengage Learning publisher, 2009, 7th edition.
5. Pumina B.C. and Jain A.K.," *Soil Mechanics and Foundations",* Laxmi publishers.

Electives 3
Syllabus for B.Tech in Civil Engineering

Course: Finite Element Analysis			Semester: VII
Course Code: CET 4111	L T P	3 0 0	Credits: 3

Objective: To develop skills to solve complex and difficult problems in structures such as with non-homogeneous material, complex loading and complicated boundary conditions, etc.

Syllabus

Introduction to Variational Formulation **9**

General field problems in engineering, modelling, discrete and continuous models, characteristics, difficulties involved in solution, the relevance and place of the finite element method, historical comments, basic concept of FEM, boundary and initial value problems, gradient and divergence theorems, functionals, variational calculus variational formulation of VBPS, the method of weighted residuals, The Ritz method

One Dimensional Problem **9**

One dimensional second order equations, discretisation of domain into elements, generalised coordinates approach, derivation of elements equations, assembly of elements equations, imposition of boundary conditions, solution of equations, Cholesky method, post processing, extension of the method to fourth order equations and their solutions, time dependant problems and their solutions, example from fluid flow and solid mechanics.

Two Dimensional Problems
9

Second order equation involving a scalar-valued function, model equation, variational formulation, finite element formulation through generalised coordinates approach, triangular elements and quadrilateral elements, convergence criteria for chosen models, interpolation functions, elements matrices and vectors, assembly of element matrices, boundary conditions, solution techniques.

Iso-parametric Elements
9

Natural coordinates in 1, 2 and 3 dimensions, use of area coordinates for triangular elements in 2 dimensional problems, isoparametric elements in 1, 2 and 3 dimensional Largrangean and serendipity elements, formulations of elements equations in one and two dimensions, numerical integration

Applications to Field Problems **9**

Equations of elasticity, plane elasticity problems, axisymmetric problems in elasticity, time dependent problems in elasticity

Suggested Readings

1. Chandrupatla, T.R., and Belegundu, A.D., "*Introduction to Finite Element in Engineering*", Third Edition, Prentice Hall, India, 2003.
2. Bhavikati, S. S., "*Finite Element Analysis*", New Age International Publishers, 2005.
3. J. N. Reddy, "*An Introduction to Finite Element Method*", McGraw-Hill, Intl. Student Edition, 1985.
4. Zienkiewics, "*The finite element method, Basic formulation and linear problems*", Vol.1, 4/e, McGraw-Hill, Book Co.
5. S. S. Rao, "*The Finite Element Method in Engineering*", Pergaman Press, 2003.

6. C. S. Desai and J. F. Abel, "*Introduction to the Finite Element Method*", Affiliated East West Press, 1972.

Course: Bridge Engineering			Semester: VII
Course Code: CET 4112	L T P	3 0 0	Credits: 3

Objective: To develop an understanding of basic concepts in design of bridges in terms of aesthetics, geographical location and functionality.

Syllabus

General Considerations **4**

Types of bridges, economic spans, aesthetics, selection of suitable type of bridge

Design Loads and their Distribution **10**

Design loads for highway and railway bridges, analysis of deck slabs, and load distribution in multi-beam bridges

Design of Superstructure **12**

Design of balanced cantilever concrete bridge, arch bridge, prestressed concrete bridge, box girder bridge, design of lattice girder railway bridges

Introduction to Cable Bridges **10**

Various types of bearings and their design

Introduction to Design of Substructure **8**

Introduction to construction/erection methods

Suggested Readings

1. Victor, D.J, "*Essential of Bridges*", Oxford and IBH Publishing Co. Pvt. Ltd
2. Krishna Raju, N., "*Design of Bridges*", Oxford and IBH Publishing Co. Pvt. Ltd
3. Ponnuswamy, S, "*Bridge Engineering*", Tata McGraw Hill Book Co. Ltd., New Delhi
4. Raina, V.K, "*Concrete Bridge Practice*", Tata McGraw Hill Book Co. Ltd., New Delhi
5. Pama, R.P and Cusens, A.R, "*Bridge Deck Analysis*," John Wiley & Sons

Course: Pavement Evaluation and Management			Semester: VII
Course Code: CET 4113	L T P	3 0 0	Credits: 3

Objective: To introduce students to performance evaluation and management of pavements with respect to highways.

Syllabus

Pavement Evaluation and Types of Distress **12**

General concept of pavement evaluation, evaluation of pavement performance, evaluation of pavement structural capacity, evaluation of pavement distress, evaluation of pavement safety, Structural and functional, serviceability, fatigue cracking, pavement deformation and low temperature shrinkage cracking, Factors affecting performance, relation between performance and distress.

Pavement Evaluation & Measuring Equipments **8**

Functional & structural evaluation, functional parameters such as roughness, distress, rutting, skid resistance etc, structural parameters such as structural capacity, Benkelman beam, bump integrator, dynaflect, demonstration of equipments for dynamic testing of pavements, digital ultrasonic concrete tester, pavement skid resistance measuring equipments, fatigue testing equipments.

Pavement Overlays

8

Flexible overlays and determination of overlay thickness, rigid overlays and determination of overlay thickness, design of overlay by Benkelman beam and falling weight deflectometer.

Design Alternatives, Analysis, Evaluation and Selection

8

Framework for pavement design, design objectives and constraints, basic structural response models, characterization of physical design inputs, generating alternative pavement design strategies, economic evaluation of alternative pavement design strategies, analysis of alternative design strategies, predicting distress, predicting performance, selection of optimal design strategies.

Pavement Management System **6**

Introduction to pavement management system (PMS) & maintenance management system (MMS), construction, maintenance and rehabilitation, feedback data system, examples of working design and management systems, implementation of a pavement management system.

Suggested Readings

1. Hass, R., Hudson, W.R. and Zaniewski, J. "*Modern Pavement Management*" Krieger.
2. Fwa, T.F., "*The Handbook of Highway Engineering*", CRC Press, Taylor & Francies Group.
3. Shain, M.Y., "*Pavement Management for Airports, Roads and Parking Lots*", Kluwer Academic Publishers Group.
4. Khanna, S.K. and Justo, C.E.G., "*Highway Engineering*" Nem Chand & Bros, Roorkee (U.A.) 8th Ed.
5. Hudson, W.R., Haas, R. and Uddin, W., "*Infrastructure Management*", McGraw Hill.

6. Hass R. & Hudson, W.R., "*Pavement Management System*", Mc Graw Hill Company, Inc. New York.

Course: Advanced Design of Steel Structures			Semester: VII
Course Code: CET 4114	L T P	3 0 0	Credits: 3

Objective: The develop skills to design and study the behavior of structural steel members such as plate girder, beams, steel tanks, roof trusses and gantry girder.

Syllabus

Design of Beams **14**

Web buckling strength, web crippling, design of built up section, design strength of laterally unsupported beams, design of laterally unsupported beams, design of grillage beams.

Design of Plate Girder **6**

Introduction, elements of plate girder, self-weight of plate girder, depth, shear buckling resistance of web, end panel design, design of bearing stiffeners, design of intermediate stiffeners, procedure for design of plate girder.

Design of Steel Tanks **10**

Introduction, design of overhead rectangular steel tank, design of elevated rectangular steel tank, elevated circular steel tanks-accessories, forces, design of elevated circular steel tank with hemispherical bottom.

Design of Roof Trusses **7**

Bracings, types of roof trusses, nomenclature of members of trusses, pitch, spacing, loads, analysis of trusses, grouping and design of members, design of truss.

Design of Gantry Girder **4**

Loads, position of moving loads for maximum effects, profile of gantry girder, design procedure for gantry girder.

Suggested Readings

1. S.S. Bhavikatti, "*Design of Steel Structures*", I. K. International Publishing House, New Delhi, 2009.
2. Dr. Ramchandra & Virendra Gehlot, "*Design of Steel Structures-2*", Scientific Publishers (India), 2010.
3. Subramanian N, "*Design of Steel Structures*", Oxford University Press, New Delhi
4. Ram K S Sai, "*Design Of Steel Structures*", Dorling Kindersley (India) Pvt. Ltd, New Delhi, 2010.
5. A.S. Arya & J. L. Ajmani "*Design of Steel Structures*" Nemchand & Bros. Fifth Edition-1996, Roorkee, India.
6. Dayaratnam P. "*Design of Steel Structures*" 2nd Edition, S. Chand Publisher-2008
7. Jain A. K.; Punmia B. C. & Jain Ashok K. "*Design of Steel Structures*", Firewall Media

IS Codes

1. IS 800:2007 Code of practice for general construction in steel
2. IS 808:1989 Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections
3. IS 6533:1989(Part I & II): Design and Construction of Steel Chimney- Code of Practice.
4. IS 805:1968: Code of Practice for Use of Steel in Gravity Water Tanks.
5. 804-1967: Specifications for Rectangular Pressed Steel Tanks.

Course: Earthquake Resistant Design			Semester: VII
Course Code: CET 4115	L T P	3 0 0	Credits: 3

Objective: To introduce students to the design of earthquake resistant structures so as to ensure stability, strength and serviceability with acceptable levels of safety under seismic effects.

Syllabus

Single Degree of Freedom Systems **9**

Formulation of equation of motion, free and forced vibrations, damping, types of damping, damped and undamped vibrations, response to dynamic loading

Modal Analysis **9**

Free and forced vibration of undamped and damped MDOF systems, equation of motions, evaluation of natural frequencies and modes, Eigen Values and Eigen Vectors

Introduction to Earthquake Engineering **9**

Elements of engineering seismology, characteristics of earthquake engineering, earthquake history, Indian seismicity

Behaviour of Structures and Soil **9**

Performance of structures under past earthquakes, lessons learnt from past earthquakes, soil liquefaction - soil structure, interaction (SSI) effects

Earthquake Resistant Design **9**

Concept of earthquake resistant design, provisions of seismic code IS 1893 (Part I), response spectrum, design spectrum, design of buildings, reinforcement detailing, provisions of IS 13920

Suggested Readings

1. Agarwal and Shrikhande., "*Earthquake Resistant Design of Structures*", Prentice Hall of India, 2007.
2. Clough R.W., and Penzien J., "*Dynamics of Structures*", McGraw, Hill International Edition 1993, 2nd Edition.
3. Damodarasamy S.R., and Kavitha S., "*Basics of Structural Dynamics and Aseismic Design*", PHI Learning Private Ltd, New Delhi, 2009

Course: Traffic Engineering and Management			Semester: VII
Course Code: CET 3116	L T P	3 0 0	Credits: 3

Objective: To introduce students to traffic engineering, regulation, planning, management and safety.

Syllabus

Traffic Planning and Characteristics **9**

Road characteristics, road user characteristics, PIEV theory, vehicle, performance characteristics, fundamentals of traffic flow, urban traffic problems in India, integrated planning of town ,country ,regional and all urban infrastructure, towards sustainable approach., land use & transport and modal integration.

Traffic Surveys **10**

Traffic Surveys, speed, journey time and delay surveys, vehicles volume survey including non-motorized transports, methods and interpretation, origin destination survey, methods and presentation, parking survey, accident analyses ,methods, interpretation and presentation, statistical applications in traffic studies and traffic forecasting, level of service, concept, applications and significance.

Traffic Design and Visual Aids **10**

Intersection design, channelization, rotary intersection design, signal design, coordination of signals, grade separation, traffic signs including VMS and road markings, significant roles of traffic control personnel, networking pedestrian facilities & cycle tracks.

Traffic Safety and Environment **8**

Road accidents, causes, effect, prevention, and cost, street lighting, traffic and environment hazards, air and noise pollution, causes, abatement measures, promotion and integration of public transportation, promotion of non-motorized transport.

Traffic Management **8**

Area traffic management system, traffic system management (TSM) with IRC standards, traffic regulatory measures, travel demand management (TDM), direct and indirect methods, congestion and parking pricing, all segregation methods, coordination among different agencies, intelligent transport system for traffic management, enforcement and education.

Suggested Readings

1. Kadiyali L.R., *"Traffic Engineering and Transport Planning"*, Khanna Publishers, Delhi, 2013.
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
3. Salter. R.I and Hounsell N.B, *"Highway Traffic Analysis and design",* Macmillan Press Ltd.1996.
4. Mannering F.L., Washburn S.S. and Kilareski W.P., *"Principles of Highway Engineering and Traffic Analysis",* Wiley India Pvt. Ltd., New Delhi, 2011.

Course: Tall Buildings			Semester: VII
Course Code: CET 4117	L T P	3 0 0	Credits: 3

Objective: To impart the knowledge of design aspects, analysis methodologies and stability analysis of tall buildings.

Syllabus

Design Criteria and Materials **9**

Development of high rise structures, general planning considerations, design philosophies - materials used for construction, high strength concrete, high performance concrete, self compacting concrete, glass, high strength steel

Loading **9**

Gravity loading, dead load, live load, live load reduction technique, impact load - construction load, sequential loading, lateral loading, wind load, earthquake load, combination of loads

Behaviour of Various Structural Systems **9**

Factors affecting growth, height and structural form, high rise, behaviour of various structural systems, rigid frames, braced frames, infilled frames, shear walls, coupled shear walls, wallframes, tubular structures, cores, outrigger, braced and hybrid mega systems.

Analysis and Design **9**

Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of buildings as total structural system considering overall integrity and major subsystem interaction, analysis for member forces, drift and twist, computerised general three dimensional analysis

Stability of Tall Buildings **9**

Overall buckling analysis of frames, wall-frames, approximate methods, second order effects of gravity of loading, p-delta analysis, simultaneous first-order and p-delta analysis, translational, torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation

Suggested Readings

1. Bryan Stafford Smith, Alex coull, "*Tall Building Structures, Analysis and Design*", John Wiley and Sons, Inc., 1991.
2. Taranath B.S., "*Structural Analysis and Design of Tall Buildings*", McGraw Hill, 2011.
3. Lin.T.Y, Stotes Burry.D, "*Structural Concepts and systems for Architects and Engineers*", John Wiley, 1988.
4. Lynn S.Beedle, "*Advances in Tall Buildings*", CBS Publishers and Distributors, Delhi, 1986.
5. Wolfgang Schueller "*High Rise Building Structures*", John Wiley and Sons, New York 1977.

Semester 2
Syllabus for B.Tech in Civil Engineering

Course: Engineering Mathematics - II			Semester: II
Course Code: MAT 1201	L T P	3 1 0	Credits: 4

Objective: To develop the ability of mathematical modelling of systems using differential equations, Laplace Transforms and their applications to various problems related to engineering and technology.

Syllabus

Differential Equation **15**

First order Differential equation, linear differential equation with constant coefficient, homogeneous equation, variation of parameter, first order P.D.E., higher order P.D.E., review of ODE, IVPs, BVPs.

Laplace Transformation **10**

Definition of Laplace transforms and Laplace transforms of some standard functions, convolution theorem, inverse Laplace transformation, the Dirac delta function and system of linear differential equations.

Series Solution **8**

Review of power series, power series solutions, classification of singular point, indicial equation, finding a second solution, learning of Bessel functions and Legendre functions, eigenvalues and Eigen functions.

Fourier Series and Transformation **8**

Fourier series, sine and cosine series, half range series and application, Fourier transform properties and examples, convolution, filters, solution of differential equations.

Application of Partial Differential Equation **6**

Method of separation of variable, solution of one dimensional wave equation, one dimensional heat equation and Laplace's equation

Suggested Readings:

1. Zill, G. Dennis;*Advanced Engineering Mathematics*, 4th Ed., 2010,Jones & Bartlett.
2. E. Kreyzig; *Advanced Engineering Mathematics*, 9th Edition, 2006, John Wiley & Sons.
3. Alan Jeffrey: *Advanced Engineering Mathematics*, 1st edition, Academic Press, 2003.
4. M.D.Raisinghania, *Ordinary & Partial Differential Equation,* S. Chand Publisher.
5. G. F. Simmons, *Differential Equations with Applications*, Tata Mc Graw Hill New Delhi.

Course: Environmental Studies			Semester: II
Course Code: HST/HSL 1201	L T P	1 0 2	Credits: 2

Objective: To familiarize students with environmental issues including environmental pollution (sources, effects and control measure) and national and international concern for environment protection and disaster management.

Syllabus

Fundamentals of Environment 7

Meaning of Environment, Types and components of environment, nature and scope of the subject, Need for environment studies, Man-environment relationship, Biogeochemical cycles (carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle, sulphur cycle).

Ecology and Ecosystem 7

Concept of ecology, population ecology, biome ecology, ecosystem ecology, pyramid of numbers, pyramid of energy, food chains and food webs in ecosystem, grazing food chain, detritus food chain, ecological interactions.

Soil, Water and Air Resources 6

Soil formation, basic properties of soil, soil erosion, wastelands, Properties of water, hydrological cycle, water resources, ground water, water table, Composition of air, structure of atmosphere.

Environmental Pollution 6

Air, water, soil – causes and effects and control measures, specially: acid rain, ozone layer depletion, green house gas effect and global warming. Waste management: prevention and control measures of solid waste (general). Effects of air pollution on human health, flora and fauna,

National Concern for Environment 6

Important environmental protection Acts in India – soil, water, air (prevention and control of pollution) act, wild life conservation and forest act. Functions of central and state pollution control boards. Issues involved in enforcement of environmental legislation.

Energy Resources and Conservation **6**

Energy resources and their exploitation, Conventional energy sources: coal, oil, biomass and nature gas (overview) – over – utilization. Non-conventional energy sources: hydroelectric power, tidal, wind, geothermal energy, solar collectors, photovoltalc, nuclear-fission and fusion. Energy use pattern and future need projection in different parts of the world, energy conservation policies.

Natural Hazards and Disaster Management **4**

Natural and man-made disasters- types, causes, onset, impacts (viz earthquake, flood, drought, cyclone, tsunamic, volcanic, landslide, industrial accidents), Forecasting and management

Suggested Readings

1. Agrawal K. M., Sikdar P. K. and Deb S. C., *A Textbook of environment*, Macmillan Publishers India Limited

2. Jeyalakshmi. R, *Principles of Environmental Studies*, 1st Edition, Devi Publications, Chennai,

2006.
3. Sharma. B. K. and Kaur, *Environmental Chemistry*, Goel Publishing House, Meerut, 1994
4. De.A.K., Environmental Chemistry, New Age International (p) lt. New Delhi, 1996
5. Dara S. S., A *Text Book of Environmental Chemistry and Pollution Control*, Chand & Company Ltd., New Delhi, 2004.
6. Nambiar R, *Textbook of Environmental Studies*, Scitech Publication (India) Pvt. Ltd., Second Edition.

List of Activities:

Environmental Activities & Responsibilities:
Plantation, Swatch Bharath Abhiyan, Ganga Swatch Abhiyan

Social Awareness & Responsibilities

Course: Engineering Chemistry			Semester: II
Course Code: CHT / CHL 1101	L T P	3 0 2	Credits: 4

Objective: To provide the fundamental knowledge of chemistry related to the engineering applications, and about coordination bonding, chemical kinetics, thermodynamics of chemical reactions, and chemistry for the formation of cells.

Syllabus

Coordination Chemistry **7**

Werner work, recent studies on complexes, effective atomic number, nomenclature of coordination compounds, shapes of d-orbitals, valence bond theory, crystal field theory, application of coordination compounds.

Thermodynamics **6**

Work and heat, first law of thermodynamics, internal energy and enthalpy, entropy and second law, absolute entropies and third law

Phase Equilibria: Pure Substances **5**

Concepts of phase, phase boundaries, the Clausius-Clapeyron equation, characteristic points (triple point, critical point etc), phase rule, phase diagrams of one component systems (water, carbon dioxide, helium-4 etc).

Ionic Equilibria **3**

Concepts of pH and pOH, acid-base titrations, buffer actions, solubility products, common ion effects

Electrochemistry **4**

Electrochemical cells, half reactions and electrodes, EMF of an electrochemical cell, cell reaction, construction of a cell, application of standard potentials.

The Rates Of Reactions **5**

Reaction rates, order and molecularity of reactions, kinetic equations of different orders, concept of activation energy, temperature dependence of reaction rates, uni-molecular reactions, steady state principle, catalyst

Water Treatment **3**

Main quality characteristics of water, hardness of water, hardness measurement, methods for the removal of hardness, chemical analysis of water

Chemistry of Engineering Materials **4**

Lime, plaster of Paris, cement, ceramics, glass, refractories, abrasives, lubricants, adhesives, explosives, rocket propellants, carbon nanotubes, targeted drug delivery materials

Polymers **5**

Composition and structure of polymer molecules, preparation, property and application of some important polymers, molecular weight of polymers, thermoplastic and thermosetting polymers, copolymers, glass transition and melting temperatures, plastics, rubbers, conducting polymers, polymers in medicine and surgery.

Suggested Readings

1. Atkins P. W, *Elements of Physical Chemistry*, 7th edition,
2. Lee J. D, *Concise Inorganic Chemistry*, Blackwell Science, OUP, 5th Edition, 1996.
3. Sharma B. K, *Industrial Chemistry*, Goel Publishing House, Meerut
4. Huhee, Keiter and Keiter, *Ino*rganic *Chemistry*, Pearson Education, 3rd Edition, 2003.
5. LevineIra. N, *Physical Chemistry*, Fifth Edition, Tata McGraw-Hill, 2002.

Course: Engineering Chemistry Lab	**Semester: II**

Objective: This course aims to provide the practical knowledge on chemistry. It imparts knowledge about titration, conductivity measurement, pH measurement, water analysis etc.

Syllabus

List of Practical

1. Colorimetric estimation of total iron using 1, 10-phenanthroline.
2. Determination of ferrous ion in a solution using ferroin indicator.
3. Estimation of strength of oxalic acid using potassium permanganate as intermediate solution.
4. Determination of ph curve of an acid base titration and dissociation constant of weak acid.
5. Dissociation constant of weak electrolyte by conductometry.
6. Determination of chloride by argentometric method [Mohr's Method].
7. Estimation of dissolved oxygen in water [Winkler's Method].
8. Determination of total hardness of water sample by EDTA titrimetric method.
9. Estimation of alkalinity in water sample.
10. Determination of hexavalent and trivalent chromium (Cr^{6+} and $Cr^{3+)}$ in water by visible Spectrometry.

Suggested Readings

1. O. P. Pandey, D. N. Bajpai and S. Giri, *Practical Chemistry*, S. Chand & Company Ltd, 2006
3. A.I. Vogel, *Qualitative Chemical Analysis*, Prentice Hall 6th Edition.
4. A.I. Vogel, *Qualitative Inorganic Analysis*, Prentice Hall 7th Edition.

Course: Introduction to "C" Programming			Semester: II
Course Code: CST / CSL 1201	L T P	3 0 2	Credits: 4

Objectives: To introduce the students to basic concepts in C programming language which includes data structures such as lists, stacks and queues.

Syllabus

Introduction **8**

Introduction to the C Language, background, C programs, creating and running programs, program development, identifiers, types, variables, constants, input / output, operators(arithmetic, relational, logical, bitwise etc.), expressions, precedence and associativity, expression evaluation, type conversions, if and switch statements, repetition statements (loops), while, for, do-while statements, loop examples, other statements related to looping, break, continue, goto, simple C program examples.

Function **8**

Functions, designing the programs, types of functions, user defined functions, function communication, standard functions, scope, storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, limitations of recursion, example c programs, preprocessor commands. Arrays: concepts, using arrays in c, array applications, two – dimensional arrays, multidimensional arrays, C program examples.

Pointer **8**

Pointers: Introduction (basic concepts), pointers for inter function communication, pointers to pointers, compatibility, pointer applications: arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions. Strings: concepts, C strings, string Input / output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

Structure and File handling **6**

Enumerated, Structure, and Union Types: the type definition, enumerated types, structures: declaration, initialization, accessing structures, operations on structures, complex structures, structures and functions, passing structures through pointers, self-referential structures, unions, bit fields, C programming examples, Input and Output: concept of a file, streams, text files and binary files, differences between text and binary files, state of a file, opening and closing files, file input / output functions (standard library input / output functions for files), C program examples.

Searching and Sorting **6**

Sorting: selection sort, insertion sort, searching: linear and binary search methods, lists: Linear list, singly linked list, basics of Tree and graphs.

Suggested readings

1. Byron Gottfried, *Programming with C*, TMH 3rd Ed.
2. E. Balaguruswamy, *Programming with ANSI C* ,TMH, 4th Ed. 2009
3. Kernigham and Richie ,*The C Programming Language* , PHI 2nd Ed. 2002
4. Yashwanth Kanithkar, *Let us C* ,BPB Publications, 8th Edition

Course: Introduction to "C" Programming Lab	**Semester: II**

List of Practical

1. Write a C program for electricity bill tacking different categories of users, different slabs in each category.(using nested if else statement)
2. Write a C program to evaluate the following using loops
   a) $1+x^2/2!+x^4/4!+$...upto 5 terms
   b) $x+x^3/3!+x^5/5!+$...upto 5 terms
3. Write a C program to check whether the given number is
   a) Prime or not
   b) Perfect or abundant or deficient
4. Write a C program to find the mean, mode, median, and variance of list of values by using one dimensional array.
5. Write a C program for Fibonacci Series.
6. Write a C program to calculate factorial using recursive function.
7. Write a C program for multiplication of two matrices.
8. Write a program to print table by using function.
9. Write a program on palindrome.
10. Write a program to print

```
1          *
12         * *
123        * * *
1234       * * * *
12345      * * * * *
```

Course: **Fundamentals of Mechanical Engineering**			Semester: **II**
Course Code: **MET/MEL 1101**	**L T P**	**2 0 4**	**Credits: 4**

Objective: To introduce the basic knowledge of Mechanical Engineering aspects like laws of thermodynamics, basic manufacturing Processes, equilibrium of forces, etc.

Syllabus

Fundamental Concepts and Definitions **6**

Definition of thermodynamics, system, surrounding and unit verse, phase, concept of continuum, macroscopic & microscopic point of view, density, specific volume, pressure, temperature. thermodynamic equilibrium, property, state, path, process, cyclic and non-cyclic processes, reversible and irreversible processes, quasi static process, energy and its forms, enthalpy, zeroth law, first law, second law, and third law of thermodynamics.

Properties of steam **4**

Properties of steam, Mollier diagram and steam tables, processes involving steam in closed and open systems, introduction to I.C. Engines: Two & four stoke S.I. and C.I. engines, Otto cycle, diesel cycle, dual cycle.

Basic Manufacturing Processes **8**

Introduction to machining processes, basic operations and operating condition on lathe, milling, shaping and drilling machines, casting processes: introduction to (pattern making, moulding sands, cores, gating system), metal forming processes: sheet metal working operations, basics of rolling, forging and extrusion processes, joining processes: welding and their types and techniques (mainly arc and gas welding), basics of soldering and brazing.

Force system and Analysis (Basic concept) **4**

Review of laws of motion, transfer of force to parallel position, resultant of planar force system, free body diagrams, equilibrium.

Stress and Strain Analysis **8**

Simple stress and strain: introduction, normal shear stresses, stress strain diagrams for ductile and brittle materials, elastic constants (Young's Modulus, etc.), one dimensional loading of members of varying cross section, strain energy, thermal stresses.

Suggested Readings

1. Kumar D.S, *Elements of Mechanical Engineering*, Kataria and Sons, 2012.
2. Singh Onkar, Bhavikatti S.S, Chandra Suresh, *Introduction to Mechanical Engineering*: *Thermodynamics, Mechanics and Strength of Materials*, New Age International Publishers.
3. Nagendra Parashar B.S, Mittal R.K, *Elements of Manufacturing Processes*, PHI Eastern Economy Edition.
4. Van Wylen G.J. & Sonntag R.E, *Fundamentals of thermodynamics*, John Wiley & Sons.

Course: Fundamental of Mechanical Engineering Lab	Semester: II

List of Practical

I. Welding Shop

1. Instruction of BI standards and reading of welding drawings.
2. Butt Joint
3. Lap Joint
4. TIG Welding
5. MIG Welding

II. Sheet Metal Shop

6. Making of Cube
7. Making of Cone using development of surface.
8. Making of control panel using development of surface.

III. Soldering Shop

9. Soldering and desoldering of Resistor in PCB.
10. Soldering and desoldering of IC in PCB.
11. Soldering and desoldering of Capacitor in PCB.

IV. Carpentry Shop

Wood sizing exercise in planning, marking, sawing, chiseling and grooving to make

12. Half lap joint
13. Cross lap joint

V. Foundry Shop

Preparation of sand mould for the following

14. Flange
15. Anvil

VI. Fitting Shop

Preparation of joints, markings, cutting and filling for making

16. V-joint
17. T-joint

VII. Machine Shop

18. Drilling and Countersinking using Drilling machine
19. Drilling and Tapping
20. Lathe Exercise, Facing operation
21. Lathe Exercise, Straight turning and Chamfering

VIII. Plumbing Shop

22. L - Joint
23. T - Joint

IX. House Wiring Shop

24. Single point wiring
25. Staircase wiring

X. Final Model to be made in combination with above experiments

Course: Fundamentals of Electrical Engineering			Semester: II
Course Code: EET / EEL 1101	L T P	3 0 2	Credits: 4

Objective: To impart a basic knowledge in Electrical Engineering with an understanding of fundamental concepts.

Syllabus

Basic Circuit Elements **8**

Introduction to Basic circuit elements , dependent and independent sources, Ohm law and it's analysis D C circuit analysis and network theorems: source transformation Kirchhoff's laws; loop and nodal methods of analysis; star-delta transformation network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem

Steady- State Analysis of Single Phase AC Circuits **10**

AC fundamentals: sinusoidal, square and triangular waveforms: average and effective values, form and peak factors, concept of phasors, phasor representation of sinusoidally varying voltage and current, analysis of series, parallel and series-parallel RLC Circuits, resonance in series and parallel circuits, bandwidth and quality factor; apparent, active & reactive powers, power factor, causes and problems of low power factor, concept of power factor improvement

Three Phase AC Circuits **7**

Three phase system-its necessity and advantages, star and delta connections, balanced supply and balanced load, line and phase voltage/current relations, three-phase power and its measurement

Measuring Instruments **5**

Types of instruments, construction and working principles of PMMC and moving iron type voltmeters & ammeters, single phase dynamometer wattmeter, use of shunts and multipliers

Introduction to Earthing and Electrical Safety **10**

Need of Earthing of equipment and devices, important electrical safety issues, magnetic circuit concepts, analogy between electric & magnetic circuits, b-h curve, hysteresis and eddy current losses, mutual coupling with dot convention, magnetic circuit calculations, single phase transformer, principle of operation, construction, EMF equation, equivalent circuit, power losses, efficiency introduction to auto transformer.

Suggested Readings

1. B L Thereaja, *A Text book on electrical technology volume 1,* S Chand; 23rd Revised edition edition
2. I J Nagrath, *Basic Electrical Engineering*, Tata McGraw-Hill Education

Course: Fundamentals of Electrical Engineering Lab	Semester: II

List of Practical

1. Measurement of Power and Power factor in Single Phase AC circuit
2. Measurement of impedance of RL, RC , RLC and study of Resonance Phenomenon
3. Performing load test on Single Phase Transformer
4. Measurement of Power in three phase AC circuit by 2 wattmeter method
5. To Verify KVL and KCL
6. To Verify Superposition Theorem
7. To Verify Thevenin Theorem
8. To Verify Norton's Theorem
9. To Verify Maximum Power Transfer Theorem
10. Project based on Fundamental of Electrical Engineering Lab

Course: Engineering Mechanics			Semester: II
Course Code: MET 1103	L T P	3 0 0	Credits: 3

Objective: To enhance the basic knowledge of students from Newton's Laws of motion to the application in bearings, bridge constructions etc.

Syllabus

Statics & Force Systems **10**

Mechanics, basic concepts, scalars and vectors, Newton's Laws, units, law of gravitation.**,** force, two-dimensional force systems, moment, couple, resultants, three-dimensional force systems, rectangular components, moment and couple, resultants.

Equilibrium **10**

Introduction, system isolation and the free body diagram, equilibrium conditions, equilibrium conditions, structures: introduction, plane trusses, method of joints, method of sections, space trusses, frames and machines.

Distributed Forces **10**

Introduction, center of mass, centroids of lines, areas, and volumes, composite bodies and figures, theorems of pappus, beams: beams, external effects, beams, internal effects, flexible cables, fluid statics.

Friction **8**

Introduction, frictional phenomena, types of friction, dry friction. applications of friction in machines, wedges, screws, journal bearings, thrust bearings; disk friction, flexible belts, rolling resistance.

Virtual Work **4**

Introduction, work, equilibrium, potential energy and stability, moments of inertia**,** introduction, area moment of inertia definitions, composite areas, products of inertia and rotation of axes, mass moment of inertia.

Suggested Readings

1. Meriam J. L and Kraige L. G, *Engineering Mechanics: Statics*, Wiley Publishers, 5th edition.
2. Nelson A., Engineering *Mechanics: Statics and Dynamics*, TMH Publishers.
3. Timoshenko S, Young .D. H, Rao J. V, *Engineering Mechanics*, TMH, 4th Ed.

Semester 4
Syllabus for B.Tech in Civil Engineering

Course: Computer Based Numerical Methods			Semester: IV
Course Code: MAT/MAL2201	L T P	3 0 2	Credits: 4

Objective: To bring out role of approximation theory in the process of developing a numerical recipe for solving an engineering problem, to introduce geometric ideas associated with the development of numerical schemes and to familiarize the student with ideas of convergence analysis of numerical methods and other analytical aspects associated with numerical computation with the help of MATLAB, C and C++.

Syllabus

Error Estimation in Numerical Methods **5**

Mathematical modeling and Engineering problem solving, Approximations and errors, Significant figures, accuracy and precision, Errors, round-off and truncation errors, error propagation, Errors in series, Representation of numbers in a computer

Roots of Equations **8**

Mathematical background, Bisection Method, Regula Falsi, Newton Raphson method, Secant Method, Successive approximation method, Muller's method, Barristow's method

Systems of Linear Algebraic Equations **8**

Mathematical background, Gauss Jordan elimination; pitfalls and techniques for improvement, matrix inversion and Gauss-Seidel methods, ill, conditional Equations, Predictor-Corrector methods, 1, E and ∞ norm of a matrix, Condition number of matrix.

Numerical Differentiation and Integration **12**

Backward, Forward and Central difference relations and their uses in Interpolation, Lagrange interpolating Polynomials, Spline interpolation, Case studies, Newton's divided differences, Numerical differentiation

Numerical Integration: Newton Cote's integration formulas; Trapezoidal rule and Simpson's rules: Interpolation, Gaussian quadrature formula.

Numerical Solution of Ordinary Differential Equations **7**

Taylor Series Method, Picard's Method, Euler's method, Runge-Kutta methods, General methods for boundary value problems, Multistep methods, Milne's Corrector and Predictor method. The shooting method, Solution through set of equations, Derivative boundary conditions, Characteristic value problems

Suggested Readings

1. C.F. Gerald, P.O. Wheatley, *Applied Numerical Analysis*, Addison, Wesley, 6th Edition, 2001.
2. Chapra S .C and Canale R. P, *Numerical Methods for engineers*, Mc-Grow Hill International Edition
3. Jain M. K, *Numerical Methods for Scientific & Engineering Computation*, New Age International.
4. Sastry.S.S, *Introduction to Numerical Analysis*, PHI
5. Atkinson K.E, *Introduction to Numerical Analysis*, John Wiley and Sons.

Course: Computer Based Numerical Techniques Lab	Semester: III

List of Practical

1. Develop a C program to find a root of a non-linear equation using Bisection method.
2. Develop a C program to find a root of a non-linear equation using False Position method.
3. Develop a C program to find a root of a non-linear equation using Secant method.
4. Develop C program to find a root of a non-linear equation using Newton-Raphson method.
5. Develop a C program to find a root of a non-linear equation using Barirstow's method
6. Develop a C program to solve linear equation using Gauss Elimination method.
7. Develop a C program to solve linear equation using Gauss Seidel method.
8. Develop a C program to compute the Gauss Jacobi Interactive methods
9. Develop a C program to compute the interpolation value using Newton's Forward Difference formula.
10. Develop a C program to compute the interpolation value using Newton's Backward Difference formula.
11. Develop a C program to compute the interpolation value using Newton's Divided Difference formula.
12. Develop a C program to compute the interpolation value using Newton's Forward Difference formula.
13. Develop a C program to implement Trepezoidal, Simpsons $1/3^{rd}$, $3/8^{th}$ Rule.

Course: Life Skills - I			Semester: IV
Course Code: HST/HSL2201	L T P	1 0 2	Credits: 2

Objective: To develop individual competence in prospective engineers and create awareness on human Ethics and Human Values.

Syllabus

Developing an Identity **7**

Self – awareness helps adolescents understand themselves and establish their personal identity. Lack of information and skills prevent them from effectively exploring their potential and establishing a positive image and sound career perspective.

Managing Emotions **5**

Adolescents have frequent mood changes reflecting feelings of anger, sadness, happiness, fear shame, guilt and love. Very often, they are unable to understand the emotional turmoil. They do not have a supportive environment in order to share their concerns with others, counseling facilities are not available.

Building Relationships **6**

As a part of growing up, adolescents redefine their relationships with parents, peers and members of the opposite sex. Adults have high expectations from them and do not understand their feelings. Adolescents need social skills for building positive and healthy relationships with others including peer of opposite sex. They need to understand the importance of mutual respect and socially defined boundaries of every relationship.

Acquiring Information, Education and Services on issues of Adolescence **7**

Exposure to media and mixed messages from the fast changing world have left adolescents with many unanswered questions, The widening gap in communication between adolescents and parents is a matter of great concern. Teachers still feel inhibited to discuss issues frankly and sensitively. Adolescents seek information from their peer group who are also ill informed and some may fall prey to quacks. Fear and hesitation prevents them from seeking knowledge on preventive methods and medical help if suffering from RTIs and STIs.

Communicating and negotiating safer life situations **5**

Sexually active adolescents face greater health risks; Girls may also face mental and emotional problems related to early sexual initiation, resisting the vulnerability to drug abuse, violence and conflict with law or society

List of Practical:

Self Development – Etiquette & Manners
Positive Attitude & Self Confidence
Motivation Skills & Personality
Development
Goal Setting
Career Planning

Suggested Readings

1. Mitra, Barun K., “Personality Development & Soft Skills”, First Edition; Oxford Publishers, 2011.
2. Kalyana; “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd, 2015.
3. James Larry “The First Book of Life Skills”; First Edition: Embassy Books, 2016.
4. Verma Shalini “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company, 2014.
5. Maxwell John C. “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc. 2014.

Course: Engineering Economics and Costing			Semester: IV
Course Code: HST 2202	L T P	3 0 0	Credits: 3

Objective: To acquaint the students with various aspects of modern management essentials, drawing up from the earlier principles & practices.

Syllabus

Introduction to Economics **10**

Introduction to Economics, Flow in an economy, law of supply and demand, concept of engineering economics, engineering efficiency, economic efficiency, scope of engineering economics, element of costs, marginal cost, marginal revenue, sunk cost, opportunity cost, break-even analysis, v ratio, elementary economic analysis, material selection for product design selection for a product, process planning.

Value Engineering **8**

Make or buy decision, value engineering, function, aims, and value engineering procedure. interest formulae and their applications, time value of money, single payment compound amount factor, single payment present worth factor, equal payment series sinking fund factor, equal payment series payment present worth factor, equal payment series capital recovery factor, uniform gradient series annual equivalent factor, effective interest rate, examples in all the methods.

Cash Flow **8**

Methods of comparison of alternatives, present worth method (revenue dominated cash flow diagram), future worth method (revenue dominated cash flow diagram, cost dominated cash flow diagram), annual equivalent method (revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, examples in all the methods.

Replacement and Maintenance Analysis **6**

Replacement and maintenance analysis, types of maintenance, types of replacement problem, determination of economic life of an asset, replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, simple probabilistic model for items which fail completely.

Depreciation **8**

Depreciation, introduction, straight line method of depreciation, declining balance method of depreciation, sum of the years digits method of depreciation, sinking fund method of depreciation/ annuity method of depreciation, service output method of depreciation, evaluation of public alternatives, introduction, examples, inflation adjusted decisions, procedure to adjust inflation, examples on comparison of alternatives and determination of economic life of asset.

Suggested Readings

1. Panneer Selvam.R, *Engineering Economics*, Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, *Managerial economics*, Oxford University press 2006.
3. Chan S.Park, *Contemporary Engineering Economics*, Prentice Hall of India, 2002.
4. Donald.G. Newman, Jerome.P.Lavelle, *Engineering Economics and analysis*, Engg. Press, Texas, 2002

Course: Advanced Fluid Mechanics			Semester: IV
Course code: CET/CEL 2201	L T P	3 0 2	Credits: 4

Objective: To familiarize the students to the practical engineering applications of fluid mechanics; such as water turbine and water pumps.

Syllabus

Open Channel Flow **12**

Fundamentals definitions and concepts, types of flow, difference between pipe flow and open flow classification of flows, geometric properties of open channels, Chezy's and Manning's equations, hydraulically best sections, uniform flow computations, specific energy and critical depth, gradually varied flow classification of channel bottom slopes, classification of surface profiles, hydraulic jump, location of hydraulic jump, surges in open channels.

Jet Flow & Turbines **13**

Force Exerted by a fluid jet on stationery flat plate and curved plate, force exerted by a fluid jet on moving flat plate and curved plates, Working principles, velocity triangles and work done, design of Pelton wheel, working principles, velocity triangles and work done, design of Pelton wheel, types of draft tubes, draft tube theory derivation of specific speed and its significance.

Pumps **10**

Reciprocating pump, types, components and working, coefficient of discharge, slip, indicator diagram, air vessel, classification, centrifugal pump components and working, velocity triangles, priming- head losses and efficiencies, minimum starting speed, performance curves, specific speed

Flow through Pipes **10**

Types of flows, Reynold's experiment, shear stress on turbulent flow, boundary layer in pipes-establishment of flow, velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in smooth and rough pipes, Stanton and Moody's diagram, Darcy's Weisbach equation, other energy losses in pipes, loss due to sudden expansion, hydraulic gradient and total energy lines, pipes in series and in parallel, equivalent pipe, branched pipe, pipe networks, hardy cross method, water hammer.

Suggested Readings

1. P.N Modi and Seth, *Hydraulics and Fluid Machines including hydraulic machines*, Rajson's publication's (Standard book house), New Delhi, 2011(18th edition).
2. Bansal, R.K, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, New Delhi, 1998.
3. Subramanya K, *Fluid Mechanics & Hydraulic Machines*, Tata McGraw Hill, Education Private Limited, New Delhi.

Course: Advanced Fluid Mechanics Lab	Semester: IV

List of Practical

1. Impact of jet
    a) On hemispherical vane.
    b) On Flat plate.
    c) On Inclined plate.
2. Free Vortex test.
3. Forced vortex test.
4. Jet pump test.
5. Centrifugal Pump test.
6. Centrifugal blower test.
7. Pelton wheel Turbine test.
8. Francis Turbine test.
9. Kaplan turbine test.

Course: Surveying II			Semester: IV
Course Code: CET/CEL 2202	L T P	3 0 2	Credits: 4

Objectives: To introduce the students to advanced methods of computation of land surveying, Tacheometry, Curves and the concepts of remote sensing and geographical information system.

Syllabus

Calculation of Area and Volume **6**

Calculation of area: introduction, determination of areas through different methods: by subdivision into triangles, from offset to a base line, area by planimeter, numerical problems, measurement of volume: measurement from cross-sections, prismoidal formula, trapezoidal formula, volume from contour plan.

Triangulation and Trilateration **6**

Control surveying and its necessity, principle of triangulation and trilateration, classification of triangulation system, station marks, satellite station, intersected and resected points, reconnaissance, intervisibility of stations, base line measurement and its extension. adjustment computations: treatment of random errors, normal law of errors, most probable value, weight of observations, propagation of errors and variances, principle of least squares.

Tacheometry **8**

Definitions, Instruments used, Methods, principles of stadia systems, instrument constants, Stadia method, inclined sights, Anallactic lens, Subtense and tangential methods, errors and precision, introduction to modern instruments: electronic distance measurement.

Curves **8**

Classification of curves, elements of simple circular, transition and vertical curves, theory and methods of setting out circular, transition and vertical curves, special field problems.

Total Station **8**

Basic principle: classifications, electro-optical system: measuring principle, working principle, sources of error, infrared and laser total station instruments, microwave system: measuring principle, working principle, sources of error, microwave total station instruments, care and maintenance of total station instruments, modern positioning systems.

Remote Sensing and GIS **8**

Remote sensing: Introduction, aerospace images, aerial photography. electromagnetic radiation (EMR), energy interaction with atmosphere and earth features, remote sensing satellite and their data products, methods of interpretation of remotely sensed data, applications of GPS in different fields of surveying, Geographical information system (GIS).

Suggested Readings

1. Punmia B.C., Ashok Jain & Arun Jain; *Surveying Vol II & III*, Laxmi Publishers 2005
2. Bannister, A. and Baker, R., *Solving Problems in Surveying*, Longman Scientific Technical
3. Agor, R. *Surveying, Vol. II&III*, Khanna Publications, New Delhi.
4. Arora K.R.; *Surveying Vol II and III*, Standard Publisher.
5. Lillesand, T.M. and Kiefer, R.W., *Remote Sensing and Image Interpretation*, Wiley India
6. Chandra, A.M., *Higher Surveying*, New Age International Publishers, New Delhi

Course: Surveying II Lab	Semester: IV

List of Practical:

1. Determination of horizontal distance between two inaccessible points by using theodolite.
2. Locating a given building by theodolite surveying.
3. Locating points on ground by plane table surveying: Radiation and Intersection method.
4. Three point problem in plane table surveying: Bessels method, Trial and error method and tracing paper method.
5. Two point problem in plane table surveying.
6. Locating a given building by plane table survey.
7. Determination of height of a building by trigonometric levelling.
8. Contour plan of a given area.
9. Measurement of area of plan by using planimeter.
10. To give layout of given plan of building.
11. To survey a small area using total station.

Suggested Readings

1. Agor R., "*Surveying", Vol. I & II*, Khanna Publications, New Delhi.
2. Arora, K. R., "*surveying", Vol. I & II*, Standard Book House, New Delhi
3. Punmia, B. C., "*Surveying*", Vol. I & II, Laxmi Publications New Delhi
4. Chandra, A.M., "*Plane Surveying*", New Age International Publishers, New Delhi.

Course: Geotechnical Engineering			Semester: IV
Course Code: CET/CEL 2203	L T P	3 0 2	Credits: 4

Objective: To understand the basic properties and strength nature of various soils and their settlement behavior in foundations.

Syllabus

Soil Properties and Compaction of Soil 9

Nature of Soil, Problems with soil, phase relation, particle size distribution, Atterberg limits, classification for engineering purposes, BIS Classification system, Soil compaction, factors affecting compaction, laboratory and field compaction methods and monitoring, Clay Minerology.

Soil Moisture, Permeability, Stresses In Soils 9

Soil water, Various forms –Capillary rise, Suction, Effective stress concepts in soil, Total, neutral and effective stress distribution in soil, Permeability, Darcy's Law- Permeability measurement in the laboratory, quick sand condition, Stress distribution in soil media, Boussinesq‟s formula, stress due to line load, Circular and rectangular loaded area, approximate methods, Use of influence charts, Westerguard equation for point load.

Shear Strength and Slope Stability 9

Shear strength of cohesive and cohesionless soil, Mohr, Coulomb failure theory, Measurement of shear strength, direct shear, Triaxial compression, UCC and Vane shear tests, Types of shear tests based on drainage and their applicability, Drained and undrained behaviour of clay and sand. Slope failure mechanisms, Modes, Infinite slopes, Finite slopes, Total and effective stress analysis, Stability analysis for purely cohesive and C Φ soils, Method of slices, Modified Bishop's method, Friction circle method, stability number.

Soil Exploration 9

Scope and objectives, Methods of exploration, averaging and boring, Wash boring and rotary drilling, Depth of boring, Spacing of bore hole, Sampling, Representative and undisturbed sampling, sampling techniques, Split spoon sampler, Thin tube sampler, Stationary piston sampler, Bore log report, Penetration tests (SPT and SCPT), Data interpretation (Strength parameters and Liquefaction potential).

Foundation, Bearing Capacity and Settlement 9

Introduction, Location and depth of foundation, Selection of foundation based on soil condition, codal provisions, bearing capacity of shallow foundation on homogeneous deposits, Terzaghi‟s formula and BIS formula, factors affecting bearing capacity, problems, Bearing Capacity from insitu tests (SPT, SCPT and plate load), Allowable bearing pressure, Settlement, Components of settlement, Determination of settlement of foundations on granular and clay deposits, Allowable settlements, Codal provision, Methods of minimising settlement, differential settlement.

Suggested Readings

1. Punmia P.C, *Soil Mechanics and Foundations*, Laxmi Publications Pvt. Ltd, New Delhi, 1995.
2. Murthy, V.N.S, "*Soil Mechanics and Foundation Engineering*", UBS Publishers Distribution Ltd, New Delhi, 1999.
3. Purushothama Raj. P., "*Soil Mechanics and Foundation Engineering*", 2nd Edition, Pearson Education, 2013
4. Coduto, D.P, *Geotechnical Engineering Principles and Practices*, Prentice Hall of India Private Limited, New Delhi, 2002.
5. McCarthy D.F, *Essentials of Soil Mechanics and Foundations Basic Geotechniques*, Sixth Edition, Prentice-Hall, New Jersey, 2002.
6. Bowles J.E, "*Foundation analysis and design*", McGraw-Hill, 1996.

Course: Geotechnical Engineering Lab	**Semester: IV**

List of Practical

1. Field density of soil by sand replacement
2. Core cutter methods
3. Specific gravity & relative density
4. Grain size distribution by hydrometer
5. Dry sieve analysis of soil
6. Atterberg limits
7. Compaction properties of soil
8. Permeability of soil
9. CBR Test
10. Direct shear test
11. Unconfined compressive strength test
12. Triaxial shear test

Suggested Readings

1. Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 2nd Edition, 2000.
2. H. S. Moondra and Rajiv Gupta, "Laboratory Manual for Civil Engineering", CBS, 2nd Edition, 2000.

Course: Analysis of Structures - I			Semester: IV
Course Code: CET 2204	L T P	3 1 0	Credits: 4

Objective: To develop skills to analyse the internal forces and other effects of loads on structures like buildings and bridges.

Syllabus

Statics of Structure and Plane Frames **9**

Equations of equilibrium, free body diagrams, sign convention, review of shear force and bending moment diagrams , introduction, plane frames, geometric stability and static determinacy of frames, analysis of trusses, assumptions, methods of analysis, method of joints, method of sections, analysis of indeterminate trusses.

Moment-Area Method, Conjugate Beam Method, Column Analogy Method **11**

Introduction, applying methods

Displacements-Energy Methods **6**

Introduction, forms of elastic strain energy, axial stress, shearing stress, multi axial state of stress, circular member in torsion, law of conservation of energy.

Slope-Deflection Method **8**

Road introduction, sign convention, development of slope-deflection equations, analysis of continuous beams, analysis of frames with no lateral translation of joints, analysis of frames with lateral translation of joints

Moment Distribution Method **6**

Introduction, absolute and relative stiffness of members, carry over factor, distribution factor (D.F), development of method, analysis of continuous beams

Suggested Readings

1. "*SMTS-II Theory of Structures (S.I. Units)",* B C Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd. New Delhi- 12th edition AUG'2004
2. Asslam Kassimali, "*Matrix Analysis of Structures*", Brooks/Cole Publishing Co., USA, 1999.
3. "*Theory of structures*" ,Vol- I", GS Pandit, SP Gupta,R Gupta, Tata Mc Graw- Hill, Seventh reprint 2012Devdas Menon, "Structural Analysis", Narosa Publishing House, 2008.
4. "*Basic Structural Analysis*", C S Reddy, Tata Mc Graw-Hill-3rd edition, 2010
5. A Ghali, A.M. Neville, T. G. Brown, "*Structural Analysis A Unified and Classical And Matrix Approach*", Spon Press Fifth Edition, First Published 2003.

Semester 5
Syllabus for B.Tech in Civil Engineering

Course: Soft Skills - II			Semester: V
Course Code: HST/HSL 3101	L T P	1 0 2	Credits: 2

Objective: To facilitate understanding of principles & behavior indicators to guide inter-personal interactions along with the skills of reading, writing, speaking.

Syllabus

Team Building & Leadership **7**

Characteristics of Effective Teams, Building & Maintaining Teams, Collaborative Communication, Managing Conflict, Giving & Receiving Feedback, Monitoring Team Development, Leadership Styles, Leadership skills & traits, Situational Leadership, Developing your leadership Style

Inter-personal skills & Networking **6**

Help participants develop clear & effective inter-personal skills, Facilitate understanding of principles & behavior indicators to guide their internal interactions, Understand how non-verbal communication may enhance interpersonal relationships, Help appreciate the model for resolving interpersonal conflicts.

Persuading, Influencing & Negotiating **8**

Melting resistance through persuasion, Working on a strategy of Negotiation, Learn tips in preparing for a negotiation, opening a negotiation, bargaining and closing a negotiation, Seeing the other side, building bridges and giving in without giving up, Understand how the use of facts and emotions can help bring people to your side, Understand empathy.

Communication Skills and Presentations **7**

Defining Effective communication, Barriers to Communication, Verbal & Non Verbal Communication, Active Listening, Business Writing, Making Telephone calls, E-Mail communication, Effective Presentations, Audience, Presenter & Content, Fear & nerves, What type of Presenter are you, The Powerful presenter, Managing the audience, Planning & Designing, Presentation ingredients, Substance, Flair & Interest, The right mix of Visual, Auditory & Kinesthetic, Visual Aids, Verbal Presentations.

List of Practical:

Relaxation exercises - Western (Autogenic Relaxation) and Indian techniques
Role- play
Social skills workshop
Transactional Analysis
Body Language
Priority Management & Time Management
Resume Building

Suggested Readings

1. Haldar, Uday Kumar Leadership and Team Building, Oxford University Press, 2010.
2. Mittal, Ranjana Leadership: Personal Effectiveness and Te: Personal Effectiveness and Team Building, Pearson Education; First edition, 2012.
3. Patterson, Kerry, Grenny, Joseph, Crucial Conversations Tools for Talking When Stakes Are High, Second Edition, New York Times best seller, Mc-Graw Hill, 2012.
4. Duarte, Nancy Resonate: Present Visual Stories that Transform Audiences, Jhon Wiley Sons, 2014.

Course: **Water Resource Engineering**			**Semester: V**
Course Code: CET 3101	**L T P**	**3 0 0**	**Credits**: **3**

Objective: To impart the knowledge of hydrology and water resources systems.

Syllabus

Hydrological Cycle **8**

Hydrologic cycle - rainfall and its measurement - computation of mean rainfall over a catchment area using arithmetic mean, theissen polygon, hydrological process, factors affecting control of evaporation on reservoirs, evapotranspiration, precipitation, forms of precipitation, introduction to hyetograph, computation of average depth of precipitation over an area, estimation of missing precipitation record, mass curve and consistency of rainfall data, runoff, infiltration indices, storm hydrograph and unit hydrograph.

Ground Water Hydrology **11**

Ground water, types of aquifers , aquifer parameters, Darcy's law, confined and unconfined aquifer, Thiem's equilibrium formula, Dupits formula, storage coefficient , coefficient of transmissibility, steady radial flow into a well located in an unconfined and confined aquifers , tube wells and open wells, yield from an open well.

Water Logging and Land Reclamation **8**

Water logging, effects, causes and measures of prevention, lining of irrigation channels, types of lining, design of lined channel land drainage, open drains, design considerations, advantages of tile drains, depth of tile drains, layout of closed drains, discharge and spacing of closed drains, diameter of tile drain, outlets for tile drains, maintenance of tile drains, purpose of land reclamation and methods of land reclamation.

River Training **7**

Classification of rivers, river training and its objectives, classification of river training works, methods of river training, marginal embankments, guide banks, spurs, cutoffs, bank pitching and launching apron.

Reservoir Planning **8**

Reservoir planning, investigations, zones of storage in a reservoir, single purpose and multipurpose reservoir, determination of storage capacity and yield, reservoir sedimentation, reservoir life, sediment prevention, flood estimation, flood forecasting, flood routing.

Suggested Readings

1. Punmia, B.C., "*Irrigation and Water Power Engineering*"., Standard Publishers, 2001.
2. H.M, Ragunath, "*Hydrology*", Willey Eastern Limited, New Delhi, 2000. G.L. Asawa, "*Irrigation and water Resources Engineering*", New age International Publishers.
3. Subramanya, "*Engineering Hydrology*", Tata-McGraw Hill, 2004.

Course: Analysis of Structures - II			Semester: V
Course Code: CET 3102	L T P	3 1 0	Credits: 4

Objective: To introduce the students to some of the advanced concepts of analysis of internal forces in structures while transferring the loads acting on it.

Syllabus

Fixed and Continuous Beams **11**

Fixed Beams, BM diagram for fixed beams UDL and triangular load on fixed beams sinking of support, fixed beams subjected to couples, continous beams, Clayperon's theorem of three moments, continuous beams with over hangs.

Rolling Loads **6**

Introduction, a single concentrated load, system of concentrated load uniformly distributed load longer than span, uniformly distributed load shorter than span.

Influence Lines **10**

ILD for reactions, shear force and bending moment at sections, absolute maximum bending moment and shear force, ILD for distributed loads, ILD for trusses, ILD for statistically indeterminate beams, Muller's Breslau's principle.

Cables and Suspension Bridges **7**

Equilibrium of loaded cord, cables carrying UDL, Suspension bridge with three hinged stiffening girder, ILD for suspension bridges.

Arches **6**

Three hinged arches, two hinged arches, temperature effects, normal thrust and radial shear, yielding of supports.

Suggested Readings

1. Punmia B.C., Jain A.K. and Jain A.K.,"*SMTS-II Theory of Structures (S.I. UNITS)*", Laxmi Publications (P) Ltd. New Delhi- 12th edition AUG'2004.
2. Kassimali A., "*Matrix Analysis of Structures*", Brooks/Cole Publishing Co., USA, 1999.
3. Pandit G.S., Gupta S.P. and Gupta R., "*Theory of structures*", Vol- I", Tata Mc Graw-Hill, Seventh reprint 2012.
4. Menon D., "Structural Analysis", Narosa Publishing House, 2008.
5. Reddy C. S., "*Basic Structural Analysis*", Tata Mc Graw-Hill-3rd edition, 2010
6. Ghali A., Neville A.M. and Brown T.G., "*Structural Analysis A Unified and Classical and Matrix Approach*", Spon Press Fifth Edition, First Published 2003.

Course: Reinforced Concrete Structures - I			Semester: V
Course Code: CET 3103	L T P	3 1 0	Credits: 4

Objective: To introduce students to different philosophies related to design of reinforced concrete structures with emphasis on limit state method and designing the basic elements of reinforced concrete structures.

Syllabus

Basic Concepts **5**

Need & advantages of using RCC over other materials, grades of concrete & steel, ingredients of concrete, compressive & tensile strength, stress-strain curves, modulus of elasticity, shrinkage and creep, workability, characteristic strengths, design stress-strain curves, working stress method and limit state design principles, characteristic load, partial safety factors for loads and material strength.

Design of Beams **14**

Theory of singly reinforced members in bending, design of singly reinforced rectangular sections, design of doubly reinforced rectangular sections, types of shear failure, shear stress calculations, design shear strength in concrete beams, types of shear reinforcements, design of links, rules for minimum shear reinforcement, critical section for shear, effective flange width, basis of design and analysis of flanged beam, T beam formulae for analysis and design, Limiting capacity of T-beam, minimum and maximum steel, transverse reinforcement, design of flanged beam in shear

Deflection, Cracking & Bond **5**

Introduction, design for limit state of deflection, bar spacing rules for beams, slabs, minimum % of steel in beam and slab for crack control, local bond, anchorage bond stress, development length, end anchorage of bars, checking of development lengths in tension and compression bars, equivalent development length of hooks and bends, splicing of bars, checking development length as per SP 16

Design of Slabs **7**

Live load calculation, considerations for design, design for shear concentrated load, action of 2-way slab, moments in two-way slab-simply supported on all four corners and with corners held down, detailing of reinforcements, procedure for design of 2-way slab with torsion at corners, concentrated load on two way slab

Design of Columns **8**

Short column, unsupported and effective lengths, slenderness limits, design of axially loaded short column, design of longitudinal steel and lateral ties, detailing, methods of design of short columns with moments, uniaxial bending, column interaction diagram, members subjected to biaxial bending, shear in column, effective length of columns- table of coefficients, woods charts

Design of Staircase **6**

Principles of design, loads applied, design of stair case spanning transversely and longitudinally, effective span, L.L, D.L, design of longitudinal stair case built into wall, design of cantilever stair case

Suggested Readings

1. Varghese P.C., *Limit State Design of Reinforced Concrete*, Prentice Hall of India, 2004.
2. Sinha S.N., "*Reinforced Concrete Design*, Second Revised Edition", Tata McGraw-Hill Education, 2002.

3. Pillai S.U. and Menon D., "*Reinforced Concrete Design*", Tata McGraw-Hill, 2003.
4. Krishna R.N., "*Reinforced Concrete Design: Principles and Practice*" New Age International- 2007.
5. Jain A.K., Punmia B. C. and Jain A.K., "*Limit State Design of Reinforced Concrete*", Firewall Media- 2007.

IS Codes

1. IS 456:2000 Plain and Reinforced Concrete, Code of Practice
2. SP 24 (S and T): 1983 Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete
3. SP 16: 1980 Design Aids for Reinforced Concrete to IS 456: 1978

Course: Environmental Engineering - I			Semester: V
Course Code: CET 3104	L T P	3 0 0	Credits: 3

Objective: To familiarize students with sources and means of water supply and sanitation and air and noise pollution along with their causes and impact on human and materials.

Syllabus

Water Supply **9**

Introduction, water demand and domestic use, variation in demand; population forecasting by various methods using logistic curve method; per capita supply, basic needs and factors affecting consumption; design period, sources of water: kinds of water sources and their characteristics, collection of surface and ground water; quality of surface and ground waters. factors governing the selection of a source of water supply; intakes and their design for lakes, streams and rivers, impounding reservoir and canal; determination of the capacity of impounding reservoir.

Transmission of Water **11**

Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements, laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control; water hammer and its control measures, storage and distribution of water: methods of distribution, pressure and gravity distribution systems, concept of service and balancing reservoirs, capacity of distribution reservoirs; general design guidelines for distribution system, Hardy-Cross method, Newton-Raphson method and equivalent pipe method of pipe network analysis, rural water supply distribution system.

Water Supply in Buildings and Houses **8**

Water connections, different cocks and pipe fittings, hot water installation, institutional and industrial water supply, water quality: drinking water characteristics, standard and quality, water treatment system, design of sedimentation, filtration and disinfection units, detailing and maintenance of treatment units.

Air Pollution **9**

Composition and structure of atmosphere; units of measurement, sources of pollutants, classification of pollutants and their effects, air quality monitoring and standards, brief introduction to control devices for particulate contaminants – gravitational settling chambers, centrifugal collectors, wet collectors, fabric filters and electrostatic precipitators, control devices for gaseous contaminants, automotive emission control, concept of clean and biofuels.

Noise Pollution and Environmental Impact Assessment **7**

Definition of decibel, sound power level, sound intensity level and sound pressure level, measurement of noise level, basic concept of community noise, transportation noise and industrial noise, acceptable outdoor and indoor noise levels, effects of noise and control measures, environmental impact assessment: introduction, proposal, development, planning and management of impact studies.

Suggested Readings

1. Garg S.K., *Water supply Engineering*, 19th Edition, Khanna Publishers, New Delhi.
2. Met Calf and Eddy, *Waste Water engineering Treatment and Reuse*, 6th Edition, Tata McGraw Hill.
3. Terence J McGhee, *Water Supply and Sewerage*, 6th Edition, McGraw Hill.
4. Fair and Geyer, *Water Supply and Wastewater Disposal*, Wiley, 1954

Course: Construction Planning & Management			Semester: V
Course Code: CET 3105	L T P	3 0 0	Credits: 3

Objective: To develop skills to plan and control the schedules and costs of work required for completing a civil engineering project and different features of project control.

Syllabus

Project Management and Techniques **8**

Introduction, project planning, scheduling, controlling, role of decision in project management techniques for analyzing alternatives: operations research, methods of planning and programming, development of bar chart shortcomings of bar charts and remedial measures, milestone charts, development of PERT networks, event, activity, dummy network rules, graphical guidelines for network, common partial situations in network numbering the events, planning for network construction, modes of network construction, steps in development of network work breakdown structure.

PERT **6**

Introduction, uncertainties: use of PERT, time estimates, frequency distribution mean, variance and standard deviation, probability distribution, the BETA distribution, expected time, earliest expected time, formulation for TE, latest allowable occurrence time formulation for TL, combined tabular computations for TE and TL slack, critical path probability of meeting scheduled

CPM **8**

Introduction, CPM: process, CPM: networks, activity time estimate, earliest event time latest allowable occurrence time, combined tabular computations for TE and TL start and finish times of activity, float critical activities and critical path project cost, indirect project cost, direct project cost, slope of direct cost curve, total project cost and optimum duration, contracting the network for cost optimization steps in time cost optimization.

Quality Control and Safety **6**

Quality and safety concerns in construction- organizing for quality and safety- work and material specifications total quality control- quality control by statistical methods- statistical quality control with sampling by attributes- statistical quality control by sampling and variables- safety

Cost Control and Accounting **6**

Cost control problem- the project budget- forecasting for activity cost control financial accounting systems and cost accounts- control of project cash flows schedule control- schedule and budget updates- relating cost and schedule information.

Organization and Project Information **6**

Types of project, information accuracy, and use of information, computerized organization and use of information, organizing information in databases relational model of data bases databases and application programs information transfer and flow

Suggested Readings

1. Punmia B.C. and Khandelwal K. K.," *Project Planning and Control with PERT and CPM",* Laxmi Publications, 4th Edition, 2002.
2. Gahlot P.S. and, Dhir B.M., "*Construction Planning and Management", New Age* International (P) Ltd., Reprint 2002.
3. Chitkara K.K.," *Construction Project Management: Planning, Scheduling and controlling",* Tata McGraw, Hill, Eighteenth Reprint 2009.
4. Jha N.K.," *Construction Project Management, Theory and Practice",* Pearson Education India, 2011.

Course: Computer Aided Drawing			Semester: V
Course Code: CEL 3106	L T P	0 0 2	Credits: 1

Objective: To develop skill to use software to create 2D and 3D models.

List of Practical:

1. Study of capabilities of software for drafting and modeling, coordinate systems (absolute, relative, polar, etc.), creation of simple figures like polygon and general multi-line figures.
2. Drawing of a title block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc.
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by the student.

Suggested Readings

1. Groover M.P. and Zimmers E.W. Jr., *CAD/CAM, Computer Aided Design and Manufacturing*, Prentice Hall of India Ltd, New Delhi, 1993.
2. Krishnamoorthy C. S. Rajeev S., *Computer Aided Design*, Narosa Publishing House, New Delhi, 1993.

Semester 6
Syllabus for B.Tech in Civil Engineering

Course: Life Skills - II			Semester: VI
Course Code: HST/HSL 3201	L T P	1 0 2	Credits: 2

Objective: To develop communication competence in prospective engineers and create awareness on Engineering Ethics and Human Values.

Syllabus

Addressing Employer Expectations **7**

Self Confidence, Domain Expertise, Integrity, Values & Ethical behavior, Adaptability to changing work environments, Learning Agility, Communication & Interpersonal Skills, Numerical & Logical ability, Cultural Fit, Working by Objectives & Result Orientation

Scoring at Group Discussions **5**

Why the need for Group Discussion?, What comprises a Group Discussion?, Personality traits the Group Discussion is trying to gauge, Importance of various skills in a Group Discussion, Employing Communication Skills, Putting knowledge & Ideas to work, Leadership & Coordinating capacities. Thought exchange, addressing the group, Using your strengths, Discussion Etiquette, Do's & Don'ts, Common Myths about Group Discussion, Leading Discussions, Summarizing a Group discussion, Exercise in Group Discussions, Strategies to improve.

Success at Interviews **6**

Types of Interviews, What to expect at an interview, Seeking information about the potential employer, How to Prepare for an Interview, Practical Preparation, on the day of the interview

Education and Services on issue of Adolescence **7**

Teachers still feel inhibited to discuss issues frankly and sensitively. Adolescents seek information from their peer group who are also ill informed and some may fall prey to quacks. Fear and hesitation prevents them from seeking knowledge on preventive methods and medical help if suffering from RTIs and STIs.

List of Practical:

Interviewing Skills
Group Discussions
Psychometric Test
Ability to work

Suggested Readings

1. Kalyana; "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd, 2015.
2. James Larry "The First Book of Life Skills"; First Edition: Embassy Books, 2016.
3. Verma Shalini "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company, 2014.
4. Maxwell John C. "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc. 2014.

Course: Environmental Engineering - II			Semester: VI
Course Code: CET/CEL 3201	L T P	3 0 2	Credits: 4

Objective: To familiarize students with sewage and sewerage systems, the physical and chemical characteristics of sewage and drainage, the types of sewage and the different processes of treatment of sewage under different conditions.

Syllabus

Sewage and Sewerage Systems **8**

Introduction to water supply and sanitation, types of sewage and types of sewerage systems, components of sewerage systems, design and planning of sewerage systems, estimation of sewage and storm discharge, hydraulic design of sewers: introduction, provisions of freeboard in sewers and S.W. drains, determination of flow velocities in sewers and drains, maximum and minimum velocities to be generated in sewers, effects of flow variation on velocity in sewer, hydraulic characteristics of circular sewer sections.

Sewage Characteristics and Disposal **7**

Importance, decay of sewage, physical characteristics of sewage, chemical characteristics of sewage and their testing, population equivalent, relative stability, collection of sewage samples, disposal of sewage: disposal by dilution, on land and sea.

Treatment of Sewage **12**

Classification of treatment processes, screening, comminutors, grit removal basins, aerated grit channels, detritus tanks, tanks for removing oils and grease, sedimentation, sedimentation aided with coagulation, secondary treatment through biological filtration of sewage, recirculation of treated sewage, other miscellaneous types of filters, secondary sedimentation, sludge disposal: digestion and disposal of primary and secondary sludge, sludge digestion process, factors affecting sledge digestion, sludge digestion tank, disposal of digested sludge.

Secondary Treatment of Sewage **9**

Activated sludge digestion: definition of activated sludge process, various operations, and design considerations involved in activated sludge plant, modifications of the basic activated sludge process, oxygen requirement, aerobic and anaerobic stabilization units: oxidation ponds and aeration lagoons, anaerobic and facultative stabilization ponds, septic tanks, imhoff tanks.

Design of Sewage Treatment Plant **8**

Design of inlet chamber, screen chamber, grit chamber, aeration tank, secondary clarifier, sludge drying beds, introduction to treatment of industrial wastes and different methods, sewage collection from house and buildings: introduction, types of traps, systems of plumbing, testing of house sewers, waste water recycling in buildings

Suggested Readings

1. Garg S.K., *Water supply Engineering*, 19th Edition, Khanna Publishers. New Delhi.
2. Peavy H S, Rowe D R and Tchobanoglous G, *Environmental Engineering*, McGraw Hill Education
3. Met Calf and Eddy, *Waste Water engineering Treatment and Reuse*, 6th Edition, Tata McGraw Hill.
4. George Tchobanoglous and Metcalf Eddy, *Wastewater Engineering: Treatment and Reuse*, Tata Mc.Graw-Hill Co.New Delhi, 2003.

5. Terence J, McGhee, *Water Supply and Sewerage*, 6th Edition, McGraw Hill 1991.
6. Punmia B.C, Jain A, *Waste Water Engineering*, 2nd Edition, Laxmi publications, New Delhi, 1998.
7. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1997.

Course: Environmental Engineering - II Lab			**Semester: VI**
Course Code: CEL 3201	**L T P**	**0 0 2**	**Credits: 1**

List of Practical:

1. Determination of turbidity, colour, and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine and chlorine demand.
5. Determination of dissolved oxygen.
6. Determination of total suspended and dissolved solids.
7. Determination of BOD of sample.
8. Determination of COD of sample.
9. Determination of Kjeldahl nitrogen.
10. Determination of fluorides.

Suggested Readings

1. Met Calf and Eddy, *Waste Water engineering Treatment and Reuse*, 6th Edition, Tata McGraw Hill
2. Peavy H S, Rowe D R and Tchobanoglous G, *Environmental Engineering*, McGraw Hill Education
3. A. P. H. A, *Standard Methods for the Examination of Water and Wastewater*, Theclassics Us, 2013

Course: Highway Engineering			Semester: VI
Course Code: CET/CEL 3202	L T P	3 0 2	Credits: 4

Objective: To give an overview about the highway engineering with respect to planning, design, construction of highways as per IRC standards, specifications and methods.

Syllabus

Introduction, Highway Development, Alignment and Surveys **6**

Importance of transportation, economic activity, social effects, role in rural development, different modes of transportation, characteristics of road transport, highway development in India, Jayakar committee and the recommendations, central road fund, Indian road congress, motor vehicle act, Nagapur road conference, central road research institute, national highway act, necessity, classification, methods, road pattern, highway alignment, requirements, factors controlling alignment, engineering surveys for highway location, map study, reconnaissance survey, preliminary survey, final location and detailed survey.

Highway Geometric Gesign **12**

Introduction, importance of geometric design, highway cross-section elements, pavement surface characteristics, pavement unevenness, cross slope or camber, width of pavement or carriageway, kerbs, road margins, width of roadway or formation , right of way, sight distance, introduction, stopping sight distance (SSD), overtaking sight distance (OSD), design of horizontal alignment, design speed, horizontal curves, super elevation, widening of pavement on horizontal curves, horizontal transition curve, design of vertical alignment, gradient, vertical curves, summit curves, valley curves

Traffic Engineering **10**

Introduction, traffic studies, spot speed study, speed and delay study, origin and destination studies, accident studies, traffic operations, traffic regulations, traffic signs, regulatory, warning signs and informatory signs, traffic signals, traffic islands, intersection at grade and grade separated intersections, rotary intersection

Design of Highway Pavements **8**

Introduction, objectives and requirements, of pavements, types of pavement structure, design factors, Design of flexible pavements, California bearing ratio method, IRC method, design of rigid pavements, general design considerations, Westergaard theory, load and temperature stresses, design of joints in rigid pavements, IRC method of rigid pavement design.

Highway Materials and Construction **8**

Subgrade soil, significance of subgrade soil, characteristics of soil, desirable properties, stone aggregates, desirable properties of road aggregates, strength , hardness ,toughness, durability, shape of aggregates, adhesion with bitumen, tests for aggregate, bituminous materials, tests on bitumen, general construction, types of highway construction, bituminous construction procedure for bituminous macadam, construction of cement concrete pavements

Suggested Readings

1. Khanna S.K. and Justo C.E.G., "*Highway Engineering*", Nem Chand & Bros, Roorkee-Eight Edition, 2001.
2. Chakroborty P., and Das A., "*Principles of Transportation Engineering*", Prentice Hall Of India Pvt. Ltd. -Second Printing December 2005.
3. Kadiyali L.R., "*Transportation Engineering*". (Vol I & II).
4. Yoder E.J., "*Principles of Pavement Design*".

IS Codes

1. IRC 37-2012, *Tentative guidelines for the design of flexible pavements.*
2. IRC 58-2002, *Guidelines for the design of Plain Jointed Rigid Pavements for Highways.*

Course: Highway Engineering Lab			**Semester: VI**
Course Code: CEL 3202	**L T P**	**0 0 2**	**Credits: 1**

Objective: This course exposes the students to various tests on aggregate and bitumen that are being used in construction of Roads/Highways.

List of practical:

Tests on Bitumen

1. To determine the Penetration value of given bitumen sample
2. To determine the Softening value of given bitumen sample
3. To determine the Ductility of given bitumen sample
4. To determine Marshall Stability and Flow values
5. To determine the Specific Gravity of given bitumen sample
6. To conduct Viscosity Test
7. To conduct Flash and Fire tests for bitumen

Tests on Aggregates

8. To find the Specific gravity and water absorption value of aggregate
9. To find Aggregate impact value of given sample of aggregate.
10. To find the Los Angeles Abrasion Value of given sample of Aggregate
11. To find the Crushing Value of given sample of Aggregate.
12. To determine the flakiness and elongation index of aggregate.

Suggested Readings

1. Khanna S. K. & Justo C.E.G., "*Highway Material Testing*", Nem Chand & Bros. Roorkee.
2. Khanna S. K. & Justo C.E.G., "*Highway Engineering*", Nem Chand & Bros. Roorkee.
3. Kadiyali L.R., "*Transportation Engineering Vol. I & II*", Khanna Publishers

Course: Concrete Technology			Semester: VI
Course Code: CET/CEL 3203	L T P	3 0 2	Credits: 4

Objective: To impart knowledge about concrete technology including study of properties of materials to be used for concrete.

Syllabus

Cement **8**

Manufacture of Portland cement, dry process, chemical composition, hydration of cement, calcium silicate hydrates, water requirements for hydration ordinary Portland cement, rapid hardening cement, sulphate resisting cement, Portland slag cement, low heat cement, Portland pozzolanas cement testing of cement, fineness test, standard consistency test, setting time test, strength test, soundness test, heat of hydration.

Aggregates and Admixtures **6**

Introduction, classification, source, size, shape, texture strength, modulus of elasticity, bulk density, specific gravity, absorption and moisture content, bulking of aggregates, measurement of moisture content of aggregates cleanliness, soundness of aggregate, alkali aggregate reaction, factors promoting the alkali-aggregate reaction, sieve analysis, qualities of water, use of sea water for mixing concrete admixtures, plasticizers, retarders, retarding plasticizers, accelerators, accelerating plasticizers, air-entraining admixture, damp proofing and water proofing admixture.

Fresh Concrete **6**

Workability, factors affecting workability, measurement of workability, slump test, compaction factor test, flow test, Kelly ball test, Vee Bee consistometer test, segregation, bleeding, setting time of concrete process of manufacture of concrete.

Hardened Concrete **13**

Elastic properties of concrete, relation between modulus of elasticity and strength, factors affecting modulus of elasticity, dynamic modulus of elasticity, creep, measurement of creep, shrinkage, plastic shrinkage, drying shrinkage, factors affecting shrinkage definition of durability, significance of durability, impact of w/c ratio on durability, joints in concrete, concrete subjected to high temperature, freezing and thawing compression test, flexural strength of concrete non-destructive testing methods, magnetic methods, electrical methods.

Concrete Mix Design **7**

Concept of mix design, American concrete institute method of mix design Indian standard recommended method of concrete mix design sampling and acceptance criteria introduction to light-weight concrete, no fines concrete, high density concrete, fibre reinforced concrete

Suggested Readings

1. Shetty M.S., *Concrete Technology Theory and Practice*, S. Chand Publishers Reprint 2013
2. Gambhir M.L., *Concrete Technology*, Tata McGraw Hill Publishing Co. Ltd sixth reprint 2006
3. Neville A.M., *Concrete Technology*, Pearson Education Ltd, 2008
4. Kulkarni P.D., *Text book of Concrete Technology*, New Age International (P) Ltd, 2007
5. Santakumar A.R., *Concrete Technology*, Oxford University Press India, 2006
6. Newman John Brian, Choo B. S., *Advanced Concrete Technology: Testing and Quality*, Elsevier Ltd, 2003.

Course: Concrete Technology Lab	Semester: VI

List of Practical

1. Standard consistency test of cement.
2. Test for setting time.
3. Fineness test on cement.
4. Soundness test on cement.
5. Bulking of sand by volume method.
6. Slump cone test.
7. Compaction factor test.
8. Vee-Bee consistometer test.
9. Compressive strength of Concrete.
10. Rebound number of hardened concrete.

Course: Estimation Costing and Evaluation			Semester: VII
Course Code: CET 3204	L T P	3 0 0	Credits: 3

Objective: To introduce students to the various aspects of estimating quantities of items of works involved in buildings, trusses canals and road works, rate analysis, valuation of properties and preparation of reports for estimation of various items.

Syllabus

Estimate of Buildings **15**

Introduction to estimation, separate or individual wall method, centre line method, estimates of a single room building, load bearing and framed structures – calculation of quantities of brick work, RCC, PCC, plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof, various types of arches, calculation of brick work and RCC works in arches, estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

Estimate of Other Structure **10**

Masonry water tanks, estimating of septic tank, sanitary and water supply installations, water supply pipe line, sewer line, tube well, open well, estimate of bituminous and cement concrete roads, estimate of retaining walls, culverts, estimating of irrigation works, aqueduct, syphon, fall.

Specification and Tenders **8**

Data, schedule of rates, analysis of rates, specifications, sources, preparation of detailed and general specifications, enders, TTT act, e-tender, preparation of tender notice and document, contract, types of contracts, drafting of contract documents, arbitration and legal requirements.

Valuation **6**

General, definition, nature of value, relationship of cost and value, supply and demand with respect of land and building, process of valuation, methods of valuation, valuation from yield, direct comparison of capital values, rent fixation, valuation of land, mortgage, lease.

Report Preparation **6**

Principles for report preparation, report on estimate of residential building, culvert, roads, water supply and sanitary installations.

Suggested Readings

1. Dutta B.N., "*Estimating and Costing in Civil Engineering*", UBS Publishers' Distributors Pvt. Ltd., 27th Edition.
2. Chakraborty M. "*Estimation, costing specification and valuation*", Paperback Publishers
3. Patil B.S., *Civil Engineering Contracts and Estimates*", Universities Press, 2006.
4. Robert L. Peurifoy, Garold D. Oberlender, "*Estimating Construction Costs*", TaTa McGraw-Hill, 5th Edition.
5. Mahaboob Basha S.,"*A Text Book of Estimating and Costing*" Anuradha Publications
6. Kohli, D.D and Kohli, R.C., "*A Text Book of Estimating and Costing (Civil)*", S. Chand & Company Ltd., 2004.

Course: Design of Steel Structures			Semester: VI
Course Code: CET3205	L T P	3 1 0	Credits: 4

Objective: The develop skills to design the common types of steel structures and the bolted and welded connections in them.

Syllabus

Introduction **4**

Common steel structures, advantages & disadvantages of steel structures, properties of structural steel, rolled steel sections, stress-strain relationship for mild steel, special considerations in design, loads, load combinations, structural analysis & design philosophy, design requirements, limit states, loads, design strength, deflection limits, other serviceability limits, and stability checks

Bolted Connections **8**

Introduction, riveted connections, bolted connections, classification of bolts, advantages & disadvantages of bolted connections, I.S specifications for spacing & edge distances of bolt holes, types of bolted connections. types of action on fasteners, assumptions-design of wearing of bolts, principles of design, design strength of plates in a joint, design strength of bearing bolt, design procedure with bearing type- bolts, subjected to shear force, efficiency of joint, eccentric connections with bearing bolts when load is in the plane of bolt, design of bearing bolts subjected to eccentric loading in the plane of bolts, tension capacity of bolts- design criteria for bolt subjected to combined shear & tension, design of bearing bolts subjected to eccentric loading causing moment in the plane & perpendicular to plane of bolts, shear and tension capacity of bolts, interaction formula for combined shear and tension, prying forces

Welded Connections **4**

Introduction, advantages & disadvantages of welded joints, important specifications for welding, design stresses in welds, reduction in design stresses in long joints, eccentric connections when load is in the plane of weld, combined axial and shear stresses, eccentric connections- moment at right angles to the plane of weld

Design of Tension members **6**

Introduction, design strength of a tension member, design procedure, tension members-splices

Design of Compression Members **13**

Introduction, buckling class of cross section, slenderness ratio, design compressive stress, is tables for design tables, shapes of compression members, design of compression members, laced and battened columns, design of laced columns, design of battened columns, design of column splices, design of column bases- design of gusseted bases

Design of Beams **5**

Plastic moment carrying capacity of a section, design procedure, bending strength of a laterally supported beam, shear strength of a laterally supported beam

Suggested Readings

1. Bhavikatti S.S., "*Design of Steel Structures (By Limit State Method As Per Is: 800- 2007)*", I.K.International Publishing House, New Delhi. -2009
2. Subramanian N, *Design of Steel Structures*, Oxford University Press, New Delhi 2008
3. Ram K S Sai, "*Design Of Steel Structures*", Dorling Kindersley(India) Pvt. Ltd, New Delhi-2010
4. Arya A.S. & Ajmani J. L. "*Design of Steel Structures*" Nemchand & Bros. Fifth Edition-1996, Roorkee
5. Ramchandra, *Design of steel structures Vol-1*, Scientific Publishers, 2007
6. Dayaratnam P. "*Design of Steel Structures*" 2nd Edition, S. Chand Publisher-2008

IS Codes

1. IS 800: 2007 Code of practice for general construction in steel
2. IS 808: 1989 Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections

Course: Structural Detailing Lab			Semester: VI
Course Code: CEL 3206	L T P	0 0 2	Credits: 1

Objective: To enable the student to have a good grasp of all the fundamentals of engineering drawing and structural reinforcement detailing of RCC structures and connection detailing of steel structures.

List of Practical

1. Detailing of simply supported, continuous and cantilever rc Beams
2. Detailing of reinforcement in composite T-beams
3. Detailing of one way and two way slabs
4. Detailing of columns: tied columns and spirally reinforced columns
5. Detailing of isolated footings
6. Combined rectangular and trapezoidal footings
7. Drawing of cross-sections of rolled steel sections
8. Detailing of eccentric and concentric connections with bolts and weld
9. Detailing of laced and battened columns
10. Detailing of built-up beams
11. Detailing of plate girders
12. Detailing of rectangular steel tanks
13. Detailing of trusses

Suggested Readings

1. Krishna Raju N., "*Structural Design and Drawing*", University Press (India), Pvt. Ltd., Hyderabad
2. Bhatt N. D., Panchal V. M., "*Engineering Drawing"*, Charotar Publishing House
3. Pritam Singh Gill, "*Engineering Drawing"*, S.K. Kataria & Sons

Semester 7
Syllabus for B.Tech in Civil Engineering

Course: **Design of Hydraulic Structures**			**Semester: VII**
Course Code: CET 4101	**L T P**	**3 0 0**	**Credits**: **3**

Objective: To impart the knowledge of irrigation standards and crop water assessment and to provide knowledge on various hydraulic structures.

Syllabus

Irrigation **7**

Irrigation: necessity of irrigation, Types of irrigation, Methods of supplying water, Assessment of irrigation water, Consumptive use and its determination, water requirement of various crops, Duty, Delta, Relation between Duty and Delta, Base period and crop period.

Diversion Head works **8**

Functions and components of a diversion head work, selection of site, type of weirs on pervious foundations, cause of failure, Bligh's creep theory and Khosla's theory, complete design of a vertical drop weir.

Dams **12**

Non overflow section, forces acting, stability rules, elementary profile, Low and High dams, drainage gallery, Construction joints - Earthen dams - stability of slopes by slip circle method, seepage analysis and its control.

Arch Dams: Development of arch dam, Valleys suited for arch dams, Arch dams layout, Types of arch dams, Appurtenant works.
Types of buttress dam, Selection of type of buttress dam, most economical profile having no tension, Design principles.

Canals and Spillways **10**

Types of canals - canal alignment - Kennedy's silt theory - Lacey's silt theory - Design of canals using the above theories - economical depth of cutting - canal losses, silt control measures.
Spillways: Factors affecting design, Components of spillways, Types of spillways, Design principles. Hydraulic design ogee spillway, Side channel spillway, Chute spillway, Syphon spillway, Shaft-spillway, Energy dissipation below spillways.

Canal falls **7**

Necessity and location, Design of sand type fall, design of a cross regulator, cross drainage works: selection of suitable type of cross drainage work, canal outlets.

Suggested Readings

1. Punmia, B.C., "*Irrigation and Water Power Engineering*", Standard Publishers, 2001.
2. Garg, S.K., "*Irrigation and Hydraulics Structures*", Khanna Publishers, 1992.
3. Creager, Justin and Hinds, "Engineering for Dams", Wiley Eastern Pvt. Ltd. Delhi.
4. Sharma, S.K., "*Principles and Practice of Irrigation Engineering*", S.Chand & Co, 1984.
5. Hydraulic Design of spillways, ASCE technical Engg. No.2, Design Guides as adapted from the US Army Corps.

Course: Prestressed Concrete Structures			Semester: VII
Course Code: CET 4102	L T P	3 0 0	Credits: 3

Objective: To introduce the different types of philosophies related to behavior of prestressed concrete members under sustained load.

Syllabus

Basic Concepts **9**

Need for prestressing, advantages and disadvantages of P.S.C. over R.C.C beams with concentric & eccentric tendons, beam with bent tendons, full prestressing and partial prestressing, high strength concrete and steel, stress- strain characteristics and properties, pre tensioning and post tensioning, system and devices, anchorages, load balancing concept, pressure line or thrust line, C line and P line, internal resisting couple, effect of loading on the tensile stress in tendon

Losses of Prestress **9**

Creep, shrinkage, relaxation of steel, shortening of member, slip in anchorage, friction, and total losses of prestress.

Design of Beams **9**

I.S. recommendations, simply supported prestressesd concrete beams, permissible stresses, principal tensile stress, shear reinforcement, vertical prestressing, shear stress and principal stress due to torsion, short term deflection, long term deflection, deflection caused by tendons, permissible deflection

Tension and Compression Member **9**

Strain in prestressed concrete tension members, tension member design on cracking and ultimate strength consideration, compression member, direct loading, direct loading and bending

End Blocks **9**

Stresses in end blocks, spalling and brusting, stresses transmission zone, Magnel's method, Guyon's method, anchor plate placed symmetrically.

Suggested Readings

1. S S Ramamrutham, *Prestressed Concrete*, Fifth Edition, Dhanpat Rai Publication company (P) LTD., New Delhi.
2. TY Lin and Ned H. Burns, *Design of Prestressed Concrete Structures*, Third Edition, John Wiley & Sons
3. N Krishna Raju, *Prestressed Concrete*, 5th Edition, McGraw Hill Education (India) Private Limited

Course: Reinforced Concrete Structures - II			Semester: VII
Course Code: CET 4103	L T P	3 1 0	Credits: 4

Objective: To introduce students to the design and detailing of concrete structures such as retaining walls, chimneys and different types of water tanks with reference to Indian standard code of practice.

Syllabus

Load Calculations **7**

IS875 Part 3 provisions for wind loads, seismic load calculations according to IS 1893

Retaining Walls **11**

Types of retaining walls, earth pressure, stability of retaining wall, depth of foundation design of cantilever retaining wall, design of counterfort retaining walls.

Chimneys **4**

Introduction, design factors, stresses due to self-weight and wind loads, stress in horizontal reinforcement, temperature stresses, design of a self-supported chimney

Water Tanks **12**

Introduction, design requirements, methods of analysis, design of circular water tanks resting on ground, design of rectangular water tanks resting on ground, overhead tanks, design of circular overhead tank

Shells and Folded Plate Roofs **5**

Introduction, types of shell roofs, advantages and disadvantages of shell roofs, behavior of folded plate roofs, behavior of shells- Lundgreen's beam theory for long shells

Suggested Readings

1. Bhavikatti S.S., "*Advance R.C.C. Design*", New Age International Publications, 2nd Edition.
2. Varghese P.C., "*Limit State Design of Reinforced Concrete",* Prentice Hall of India, 2004.
3. Punmia B. C., Jain A.K. and Jain A.K., "*Comprehensive RCC Designs*", Laxmi Publications, 2006.
4. Krishna R. N., "*Structural Design and Drawing: Reinforced Concrete and Steel*" Universities Press-2005.
5. Nilson A.H., "*Design of Concrete Structures*", Tata McGraw-Hill, 12th edition.

IS Codes

1. IS 456 : 2000 Plain and Reinforced Concrete - Code of Practice
2. SP 34 : 1987 Handbook on Concrete Reinforcement and Detailing
3. IS 875 : (Part 1-III) : 1987 Code of practice for design loads (other than earthquake) for buildings and structures
4. IS 1343: 1980 Code of practice for Prestressed Concrete
5. 3370 (parts I- IV):1999 -Code of Practice for Concrete Structures for the Storage of Liquid
6. IS 4998(Part 1):1992 :Criteria for Design of Reinforced Concrete Chimneys

Course: **Railways and Airport Engineering**			**Semester: VII**
Course Code: CET 4104	**L T P**	**3 0 0**	**Credits**: **3**

Objective: To impart the knowledge of layout and planning of railways tracks, airports and runways.

Syllabus

Railways **10**

Rail transportation and its importance in India, permanent way: requirements and components, gauges in India and abroad, selection of gauge, coning of wheels, adzing of sleepers, rails: functions, composition of rail steel, types of rail sections, requirements of an ideal rail section, length of rails, defects in rails, creep of rails, long welded rails and continuously welded rails, Sleepers: functions, requirements of an ideal sleeper, types of sleepers: wooden, cast iron, steel and concrete sleepers, advantages, disadvantages and suitability of each type, sleeper density, fastenings for various types of sleepers: fish plates, spikes, bolts, bearing plates, keys, chairs, jaws, tie bars, elastic fastenings, ballast: functions, requirements, types of ballast and their suitability.

Crossings and Train Control **10**

Necessity, turnout: various components, working principle, switch: components, types, crossing: components and types, design elements of a turnout, design of a simple turnout, layout plan of track junctions: crossovers, diamond crossing, single-double slips, throw switch, turn table, triangle, Signals: objects, types and classification, semaphore signal: components, working principle, requirements / principles of a good interlocking system, brief introduction to devices used in interlocking, methods of control of train movements: absolute block system, automatic block system, centralized train control and automatic train control systems.

Design and Maintenance of Track **10**

Gradients, grade compensation, super elevation, cant deficiency, negative super elevation, maximum permissible speed on curves, tractive resistances, types, hauling capacity of a locomotive, Stations: functions and classification, junction, non-junction and terminal stations, yards: functions, types, marshalling yard: functions, types, maintenance of railway track: necessity, types of maintenance, brief introduction to mechanized maintenance, M.S.P and D.T.M.

Airport Planning and Runway Design **12**

Air transportation, its importance and characteristics, status in India, layout plan of an airport and its basic elements: terminal area, apron, taxiway, runway, hanger, aircraft characteristics, their effect on elements of an airport, site selection of an airport, classification of airports, Runway orientation, wind rose diagram, basic runway length, corrections to basic runway length, runway patterns, difference between highway and runway pavement, types of runway pavements, design factors for runway pavement, brief introduction to design of thickness of a runway pavement.

Suggested Readings

1. S. C. Saxena, S. P. Arora, *A text book of Railway Engineering*, Dhanpat Rai Publicatios
2. J. S. Mundray, *Railway Track Engg.*, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
3. S.K.Khanna, M.G.Arora, *Airport Planning and Design*, Nem Chand Bros., Roorkee.
4. Robort Hornjeff, *The Planning and Design of Airports*, McGraw Hill Book Co.
5. V. Kumar & S. Chandra, *Air Transportation Planning and Design*, Galgotia Publications.

Course: Computer Aided Structural Design			Semester: VII
Course Code: CEL 4105	L T P	0 0 2	Credits: 1

Objective: To introduce the students about structural analysis, design and optimization with the help of Structural Engineering Design Packages such as STAAD Pro.

List of Practical:

1. Introduction to latest version of a standard structural engineering design package such as STAAD Pro.
2. Geometrical modeling of RCC frame on latest version of a standard structural engineering design package such as STAAD Pro.
3. Modeling of loads and load combinations on RCC frame on latest version of a standard structural engineering design package such as STAAD Pro.
4. Analysis and interpretation of results of analysis of RCC frame on latest version of a standard structural engineering design package such as STAAD Pro.
5. Design of RCC frame on latest version of a standard structural engineering design package such as STAAD Pro.
6. Interpretation of results of design of RCC frame on latest version of a standard structural engineering design package such as STAAD Pro.
7. Geometrical modeling of steel frame on latest version of a standard structural engineering design package such as STAAD Pro.
8. Modeling of loads and load combinations on Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.
9. Analysis and interpretation of results of analysis of steel frame on latest version of a standard structural engineering design package such as STAAD Pro.
10. Design of steel frame on latest version of a standard structural engineering design package such as STAAD Pro.
11. Interpretation of results of design of steel frame on latest version of a standard structural engineering design package such as STAAD Pro.
12. Design of RCC column on latest version of a standard structural engineering design package such as STAAD.etc
13. Design of RCC isolated footing on latest version of a standard structural engineering design package such as STAAD.etc
14. Case study of design of a RCC multistory building on latest version of a standard structural engineering design package such as STAAD Pro.
15. Case study of design of a steel industrial building on latest version of a standard structural engineering design package such as STAAD Pro.

Note: Plotting of drawings must be made for each exercise and attached to the records written by the student.

Suggested Readings

1. Reference Manual for Respective Software (such as STAAD Pro)
2. Verification Manual of Respective Software (such as STAAD Pro)