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<th>Sub code No.</th>
<th>Subject Title</th>
<th>Teaching Scheme Hours per week</th>
<th>Examination Scheme</th>
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<td>401001</td>
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<td>Dams and Hydraulic Structures</td>
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* It is mandatory to present a seminar and submit report based on work of first semester.

** Theory paper of 4 hrs. duration

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<th>Sub code No.</th>
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<td>Quantity Surveying ,Contracts and Tenders</td>
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<td>4010010</td>
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** Theory paper of 4 hrs. duration

### Semester I

#### Elective-I
1. Structural Design of Bridges
2. Systems Approach in Civil Engineering
3. Air Pollution and Control
4. Architecture and Town Planning
5. Advanced Geotechnical Engineering

#### Elective-II
1. Matrix Methods of Structural Analysis
2. Hydroinformatics
3. TQM & MIS in Civil Engineering
4. Earthquake Engineering
5. Advanced Concrete Technology

### Semester II

#### Elective-III
1. Advanced Structural Design
2. Advanced Foundation Engineering
3. Advanced Engineering Geology with Rock Mechanics
4. Advanced Environmental Management
5. Construction Management

#### Elective-IV
1. Integrated Water Resources and Planning
2. Advanced Transportation Engineering

4. **Open Elective**
   a) Finite Element Method in civil engg.
   b) Geoinformatics
   c) Hydropower Engineering
   d) Industrial Waste Water Management
The concept of opting for open elective has the following objectives:

i) To strengthen industry-institute interactions.

ii) To promote interdisciplinary exchange of knowledge.

**Methodology to opt:** Keeping above objectives in mind, the civil engg. department of any college will establish tie-up with industry and take advantage of experts from industry and academics. The draft of syllabi will be prepared. Such draft shall be forwarded to B.O.S. The B.O.S. shall approve this draft and send to faculty of engg. and academic council for their approval. The department can start such open elective only after approvals from B.O.S., faculty of engg., and academic council. Considering the time involved in the entire process, departments are advised to initiate this process well in advance. However, no department can start any open elective without prior permission and approval of BOS before commencement of term.

The syllabus of following open electives is approved so far. Any department can opt for following subjects under open elective or suggest another, under binding of above methodology.

**List of open electives approved:**

**Elective IV (401 008) iv) Open Elective**

a) Finite Element Method
b) Geoinformatics
c) Hydropower Engineering
d) Industrial Waste Water Management
Unit I


(5 Hrs)


(4 Hrs)

Unit II

**Stream sanitation:** Self purification of natural streams, river classification as per MoEF, Govt. of India & effluent discharge standards as per BIS 2490, Oxygen Sag Curve, Streeter - Phelps equation and terminology (without derivation and numerical).

**Sewage treatment:** Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.  

(8 Hrs)

Unit III

**Theory & design of secondary treatment units:** Introduction to unit process and unit operations for secondary treatment. Biological principle, important microorganisms in waste water & their importance in waste water treatment systems, bacterial growth, general growth pattern, growth in terms of bacterial numbers and bacterial mass. Kinetics
substrate limited growth, cell growth and substrate metabolism.

**Activated sludge process:** Design of ASP, sludge volume index, sludge bulking & control. Types of ASP.

**Trickling filter:** Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contractors.  

*Unit IV*

Low cost treatment methods:

**Oxidation pond:** Bacteria–algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds.

**Aerated lagoons:** Principle, aeration method, advantages & disadvantages of aerated lagoons.


*Unit V*

**Theory & design of anaerobic treatment units:** Septic tanks, suitable conditions & situations, biological principle, method of treatment & disposal of septic tank effluent.

Design of septic tank along with up flow filters and soak pit.

**Anaerobic digester:** Principal of anaerobic digestion, stages of digestion, bio gas production its characteristics & application, factors governing anaerobic digestion, design of anaerobic digesters. Such as gravity thickener, sludge drying bed, decanters.


*(9 Hrs)*

*(6 Hrs)*

*(8 Hrs)*
Unit VI

Waste treatment: Methods of sampling. Equalization and neutralization. Application of preliminary, primary and secondary treatment for industrial wastewater as per the pollution control norms.

Sources of waste water from manufacturing process, characteristics of effluent, different methods of treatment & disposal of effluent for the following industries:

Sugar, dairy, distillery, paper & pulp and textile. Flowchart and automobile industry. Discharge standards as per pollution control norms. (8 Hrs)

Term Work

The term work shall consist of a journal giving details of at least 8 out of 12 of the following experiments of which Sr.No.12 is compulsory.

1. Solids -Total solids, suspended solids, volatile solids, settleable solids & non settleable solids.
2. Sludge Volume Index.
3. Dissolved oxygen.
5. Chemical Oxygen Demand.
7. Determination of Phosphates by spectrophotometer.
8. Determination of Nitrates by spectrophotometer.
9. Determination of heavy metals like Cr$^{6+}$ or Zn or Ni or Cd.
10. Determination of total nitrogen by kjeldal method
12. Computer aided design of Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP) using suitable software such as;
b) C programming or any other suitable software.

Note: - Term Work should include a detailed analysis of practical interpretation, significance and application of test results.

**Reference Books**

1. Environmental studies by Rajgopalan- Oxford University Press.
2. Waste Water Treatment & Disposal ï Metcalf & Eddy - TMH publication.
9. Manual on sewerage and sewage treatment ï Public Health Dept., Govt. of India.

**I.S. Codes**

I.S. 3025 (all parts)

**e - Resources**

i) http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.
ii) http://cpcb.nic.in
iii) http://moef.nic.in
401002 DAMS AND HYDRAULIC STRUCTURES

Teaching scheme:
Lecture: 4 Hrs/week
Practical: 2 Hrs /week

Examination Scheme:
Paper : 100 Marks
Oral : 50 Marks
TW : 25 Marks
Duration : 3 Hrs.

Unit I


Dam safety : I.S.guildelines and recommendations Ž restoration and retrofitting Ž strengthening of dams Ž maintenance of dams Ž field monitoring Ž dam instrumentation-piezometers Ž settlement systems and cells Ž inclinometers Ž tiltmeters Ž pendulums-extensometers Ž different gauges and cells- cracks and joint meters.

Arch dam (Introduction level): Introduction Ž concept-conditions favouring-layout-classification- forces acting-design of arch dam- basic assumptions- different design method.

Unit II


Unit III

Earth dams : Introduction- conditions favoring Ž limitations- classification Ž investigation for earth dam-seepage analysis-plotting of seepage line-properties of seepage line- structural stability analysis- forces acting- swedish circle method-stability
Unit IV

**Spillways:** Introduction - data collection-principles of spillway-key levels-site selection-components - classification- principles of hydraulic design of ogee and open channel (chute) spillway- energy dissipation devices-different types of basins and buckets-correlations between jump height and tail water depth.

**Gates** – Types of spillway gates like vertical gates- radial gates - automatic gates etc. - operation of gates - inspection and maintenance of gate - safety of gates.

**Diversion head works:** Selection of site- layout of work - types of weirs and barrages-design for subsurface flow-safety against piping and uplift. Uplift theories such as Bligh, Lane and Khosla’s theories - design of weirs on permeable foundations.

Unit V

**Canal:** Introduction-types - components - selection of canal alignment-procedure for fixing alignment- data required for design-hydraulics of sediment transport- regimes of flow-sediment transport in canal-different sediment loads- sediment transport theory-semi theoretical approach- empirical approach- critical active force- shield’s theory-design of stable canal in alluvial beds - Kennedy’s theory-lacey’s theory - design of irrigation canal based on crop water requirement- losses in canals- canal lining-advantages-limitations-requirements-types-cost economics of lining- maintenance of canals.

**C.D. works:** Types- Selection of appropriate type - necessity - design principles.

**Canal falls:** Introduction - necessity - site selection- classification- types - selection of type - components- design (introduction) - construction of fall (introduction).

**Canal regulators:** Cross and head regulators- functions and design - escapes- definition - necessity- types-outlets- classification- types of outlets- types of modular, non modular and semi modular outlets.
Unit VI

**River training & bank protection:** Objectives of river training- methods of river training- principles of design and construction of river training works- various measures of protection works.

**Hydro-power:** Types of hydropower plants such as runoff type- storage type-pumped storage type- tidal- mini & micro- general layout of different types- assessment of power potential- main components of hydro- power schemes- underground power house- different terms of hydropower like load factor - utilization factor, capacity factor- different heads and efficiencies.

**Term Work**

Minimum seven assignments as per the list given below.

**Group I:** All assignments compulsory.
1. Marking catchment area on a topo sheet and working out average annual rainfall and determining yield by various methods.
2. Stability analysis of gravity dam.
4. Design of spillway and stilling basin.
5. Design of canals.

**Group –II** Any one of the following:
1. Design and analysis of a weir on permeable foundation.
2. Design of any one type cross drainage works.
3. Design of any one type of canal fall and standing wave flume.

**Group –III** Any one of the following:
1. To develop a unit hydrograph and to draw a flood hydrograph for given two or three successive rainfall in basin of a water resources project.
2. Benefit cost analysis of a water resources project.
3. Design of any one type of river training work.
4. A typical layout of a high head hydropower plant, functions of all the components
5. A report based on visits to any irrigation projects during the second semester.

Oral: Based on above syllabus and term work.

Reference Books


I.S. Codes

4. I.S. 10135 ï 1985, Code of practice for drainage system for gravity dams, their


7. I.S. 6934 ð 1998 (Reaffirmed 2003), Hydraulic design of high ogee overflow spillways ð recommendations, first revision, B.I.S. New Delhi.


401003 STRUCTURAL DESIGN III

Teaching Scheme:
Lectures: 4 Hrs / week
Practical: 2 Hrs/week

Examination Scheme:
Paper : 100 Marks
Oral : 50 Marks
TW : 25 Marks
Duration : 4 Hrs.

Unit I

a) Prestressed concrete structures- Introduction- Basic concepts,-materials-various
   Pretensioning and post tensioning systems,-concept of Losses.
b) Stress calculations, concept of cable profile.

Unit-II

a) Design of Prestressed concrete simply supported rectangular and flange sections for
   flexure and shear including end block.
b) Design of one way and two way post tensioned slabs (Single panel only)

Unit-III

a) Earthquake loads by seismic coefficient method- Estimation of combined effect of
   lateral
   and vertical loading in multi storeyed frames.
b) Design of an intermediate continuous beam within the above structure.

Unit IV

a) Design of Water tanks- circular and rectangular with flexible and rigid base- resting on
   ground by approximate and IS code method.
b) Design of rectangular combined footing- with and without strap beam.
c) Design of Cantilever retaining wall- Tee and Ell shapes.

Note: Design based on above unit shall conform to latest versions of I.S. 456, I.S. 875,
I.S. 1343,
I.S. 3370, I.S. 1893, I.S. 13920.
**Term Work**

Term work shall be based on the above syllabus. It consists of

1) Assignment on part ‘a’ of unit I and unit III each

2) Minimum three full imperial sheets based on two projects of RCC and one project of pre-stressed concrete.

3) Report on analysis of assignment on unit III by software or computer program

4) Two site visit reports one each of R.C.C. and another P.S.C.

**Oral Examination:** Oral based on above term work

**Reference Books**

1. Limit state theory and design of reinforced - Dr. V. L. Shah and Dr S. R. Karve
   Concrete, Structures Publications


3. Advanced design of structures- Krishnaraju - Mc Graw Hill


7. Design of design of reinforced Concrete structures- M. L. Gambhir -PHI


9. Prestressed Concrete Í A Fundamental Approach- Edward Nawy Í PHI.

**I.S. Codes**


Structural Design of Bridges

Unit I
Types of highway bridges, RC & prestressed bridges, structural arrangement for slab, T-beam, box grader, balanced cantilever, continuous girders, rigid frame, arch, bow string, cable stayed bridges, curved and skew bridges.
Standard specifications of road bridges, width of carriage way, clearances, IRC classification for live loads, dead load, impact, longitudinal and centrifugal forces, horizontal forces due to water current, buoyancy effect, earth pressure and seismic forces.

Unit II
T-Beam type bridge: Components, number and spacing of main girders, RC design of deck slab using load distribution by Pigeoud’s curves, IRC class AA tracked and wheeled vehicle. Design of cantilever slab.

Unit III
Prestressed concrete design of intermediate and end longitudinal girders. Design based on analysis by Courbon’s method, design of end block. Design of elastomeric pad bearings.

Unit IV
Types of railway steel bridges, deck and through type truss bridges and plate girder bridges, arch bridges.
Classification of railway tracks, standard axle and train loads for different tracks, equivalent UDL, dynamic effect, Impact factor, longitudinal forces, racking forces, wind and seismic forces.

Unit V
Truss bridges: Structural arrangements for deck and through type railway Bridges, width and clearances, analysis and design of members of steel truss bridge, typical connection details at joints.
Unit VI

Bracing systems in deck and through type truss bridges, analysis and design of horizontal truss bracings at chord levels. Various arrangements of portal bracings, mechanical bearings, design of rocker and roller bearings.

Term Work

Term work shall consist of at least two assignments from unit one to three and at least two assignments from unit four to six out of which one shall be based on use of standard computer software. In addition to this, a visit report be enclosed for any one type of bridge.

Reference Books

4) Design of Steel Structures Vol II ï Ramchandra, Standard Book House, Delhi.

Codes

5) Indian Road Congress ï Standard Specifications and Code of Practices for Road Bridges.
6) IRC 18 ï 1985, Design Criteria for Prestressed concrete road bridges (Post Tensioned Concrete)
Unit 1
Use of systems approach in Civil Engineering and managerial decision making process.
Introduction to Optimization Techniques and their application in Engineering Planning, design and Construction, Various models, Objective function and constraints, convex and concave functions, regions and sets.

Linear programming: Formulation of Linear optimization models for Civil engineering applications. The simplex method, special cases in simplex method, Method of Big M, Two phase method, duality, sensitivity analysis. (9 Hrs)

Unit II
Linear programming -
The Transportation Model and its variants, Assignment Model, and its variants (8 Hrs)

Unit III
Dynamic programming:
Multi stage decision processes, Principle of optimality, recursive equation, Applications, various models of D.P. (8 Hrs)

Unit IV
Non-Linear programming:
a) Single variable unconstrained optimization ñ Local & Global optima, unimodal function, Sequential Search Techniques-Dichotomous, Fibonacci, Golden section.
b) Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton’s Method.
c) Multivariable optimization with equality constraints-Lagrange Multiplier Technique. (9 Hrs)
Unit V

Queueing theory, simulation, sequencing model in n jobs through 2, 3 and M machines.

(8 Hrs)

Unit VI

Games theory, Replacement models

(8 Hrs)

Term Work

1. One exercise on each unit. Out of these any two problems to be solved using computer
2. One exercise on formulation of a problem applicable to any field of Civil Engineering, requiring use of LP/NLP/DP. Formulation of objective function and constraints (No solution)

Reference Books

1. Operations Research by Hamdy A. Taha
2. Engineering Optimization by S.S. Rao
3. Quantitative Techniques in Management by N.D. Vohra (Mc Graw Hill)
4. Topics in Management Science by Robert E. Markland (Wiley Publication)
5. An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen

e - Resources

1. Mathematical Model for Optimization (MMO Software)
2. nptel.iitm.ac.in/courses/webcourse-contents/IISc-Bang/OPTIMISATION METHODS/New-index1.html
Unit I


Unit II

Air sampling and analysis: Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling gases and particulars. Stack emission monitoring, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring.

Unit III

Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems.

Odour pollution: Theory, sources, measurement and methods of control of odour pollution.

Unit IV

Control of air pollution: By process modification, change of raw materials, fuels, process equipment and process operation. By use of air pollution control equipment for particulate and gaseous pollutants. Design of control equipment as Settling chamber, Cyclone, Fabric filter, Electrostatic precipitator and Wet scrubber. Control of air pollution from automobiles.

Unit V

Land use planning: As a method of control.

Economics of air pollution control: Cost/benefit ratio and optimization.

Unit VI
Environmental impact assessment and management:

Term Work
Term work shall consist of assignments on all above units, detailed report on any two of the above chapters and one industrial visit report.

Reference Books
2) Air pollution Í KVSG Murali krishna.
3) Air Pollution Í Perkins.
6) Air Pollution Í Stern.
7) Air Pollution Control Í Martin Crawford.

I.S. Codes
1) I.S. 5182 (all parts), I.S. 15442 (2004)

e - Resources
1) http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.
2) http://cpcb.nic.in
3) http://moef.nic.in
ARCHITECTURE AND TOWN PLANNING

Teaching Scheme:
Lectures: 4 Hrs/week
Practicals: 2 Hrs / week

Examination Scheme:
Theory : 100 Marks
TW    : 25 Marks
Duration : 3 Hrs.

Section I: Architecture

Unit-I
A: Architecture: role of “urban planner and architect” in planning and designing.
   Necessity of integrated approach.
A) Principles of architecture
B) Qualities of architecture: user friendly, ecofriendly, utility of spaces, future growth, spanning, environmental filter (town-building)
C) Architectural composition and elements of design.
B: Landscaping: Environmental art and design for urban landscape.
Objectives, principles, elements, material, soft landscaping, hard landscaping, and garden styles: modern and historical, water body conservation and creation.

Unit-II
a) Built environment in urban areas-need, concept and importance of byelaws, enriching the spaces as per functional needs
b) Urban design and renewal for quality of life and livebility

Unit-III
Sustainable development
A) Advantages and usage of sustainable materials and sustainable technologies.
B) Green building concept, rating systems. case study of rated buildings.
Unit IV

A) Objective of town planning, principles, stages in town development, growth of towns and theories of developments (ribbon, sector zone, concentric, multiple zone etc).

B) Study of new towns and planned towns like new mumbai, gandhinagar, pcntda (infrastructure, disaster management etc).

C) Neighborhood planning and role in urban development, town planning schemes, garden city & three magnet theory, green belts.

Unit V

A) Levels in planning - regional/city/neighborhood.

City development plan

1) Scope & purpose
2) Surveys - demographic, housing, land use, ws & sanitation, etc.
3) Traffic; transport - urban road objectives, classification, traffic management.

B) Legislative mechanism for dp: mrtp, planning agencies for various levels of planning, their organisation and purpose (cidco-mhada-midc).

Unit VI

A) Acts - land acquisition, udpfi (for land use, infrastructure etc), sez, spl townships

B) Application of gis, gps remote sensing in planning.

Term Work

1: Study of post independence modern building in India by a renowned architect. (individual work - any two buildings)

2: Study and analysis of city maps of either of an existing town / town area with respect to services, infrastructure, street furniture, housing etc. (individual / group work)
3: Study of housing complexes or townships, role of estate manager ï report to be prepared (group work)

4: Neighbourhood plan. (group work)

5: Softwares related to planning. (group work)

6: Study of salient features of jnurrn

Reference Books

1. Principles of architecture by Methushoba ï Mohan - Oxford University Press

2. Town planning by G.K. Hiraskar

3. Town planning by S. Rangwala

4. MRTP act 1966

5. Landacquisition act 1894

6. UDPFI guidelines, ministry of urban affairs and employment, Govt. & India.

7. Manual of tropical housing and building by koenigsbeger


9. Sustainable building design manual


13. The engineering guide to LEED- new construction-sustainable construction for engineers haselbach
Unit I

(a) Soil classification
Identification and classification, criteria for classifying soil - classification on the basis of grain size, plasticity, symbolic & graphic presentation. Classified soils and engineering properties.

(b) Soil structure & clay minerals

Unit II

(a) Earth pressure theory
Earth pressure theories for calculation of active and passive pressure, Rankines and coulombs earth pressure theories, analytical and graphical methods.

(b) Design of earth retaining structures
Design of gravity and cantilever retaining walls, design - cantilever sheet pile walls, anchored sheet pile walls, timbering and bracing for open cuts.

Unit III

(a) Geosynthetics
Geosynthetics- types, functions, properties and functional requirements. Application of geosynthetics in geoenviroment.

(b) Reinforced soil

Unit IV

(a) Soil behavior under dynamic loads
Soil behavior under static and dynamic loads. Acceptable levels of strain under static and dynamic loading. Soil properties relevant for dynamic loading and its determination.

Unit V

Ground Improvement
In-situ ground improvement by compaction piles, dynamic loads, sand drains, grouting, deep mixing, inserting reinforcement elements, freezing soil, and vibroflotation.

Unit VI

Rheology
Rheological elements, basic and composite rheological models. Examples of compound models used to explain different soil phenomena; such as secondary consolidation, creep etc.

Term Work

(A) Experiments to be conducted (Any Three)
1) Plummets balance / Hydrometer Analysis.
2) Consolidation test.
3) Swelling Pressure Test.
4) Triaxial test with measurement of pore pressure.

(B) Assignments (Any Four)
1) Soil Classification.
2) Computation of Earth pressure behind Retaining Wall by Analytical method.
3) Computation of Earth pressure behind Retaining Wall by Graphical method.
4) Typical slope design with reinforced soil / Geosynthetics.
5) Design of machine foundation.

(B) Computer programme / Software package for solution of two topics covered in theory.

* Oral Examination will be based on the above term work.
A) Reference Books

1. Physical and Geotechnical properties of soils - Joseph E. Bowels, Tata Mac-Grawhill
3. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta - Tata Mc-Grawhill

B) I.S. Codes

1. IS: 1892-1979 "Code of Practice for Subsurface Investigation for Foundation"

C) Handbooks


D) e Resources

1. Website www.nptel.iitm.ac.in
Unit I
Review of Matrix Algebra, Numerical methods for inversion of matrix such as Gauss Elimination, Solution of simultaneous equations, Gauss Jordon & Gauss Seidel iteration methods
Computer Algorithm & Programming aspects

Unit II
Flexibility Method, Selection of Redundant, Flexibility Matrix, Analysis of pin jointed indeterminate trusses, Continuous beams & Simple Portal Frames involving not more than three unknowns.

Unit III
Stiffness method, member stiffness matrix, effective node numbering, assembly, banded matrix, Analysis of determinate / indeterminate structures such as pin jointed trusses & beams, Member and Structure approach.

Unit IV
Stiffness matrix for portal frame member, Transformation matrix, Member and Structure approach, Problems involving not more than three unknowns

Unit V
Stiffness method for analysis of orthogonal grid structure, member stiffness matrix, transformation matrix, member & structure approach

Unit VI
a) Stiffness method for analysis of Space truss. Problems involving not more than three unknowns, Space frame, Formulation of member stiffness matrix for space frame member, Substructure Technique.
b) Software applications for analysis of skeletal structures, input data, Generation of geometry of structure, software solution & Presentation of output.
Reference Books


3) Problems in structural Analysis by Matrix Methods ñ P Bhatt, Wheeler Publication

4) Advanced Structural Analysis ñ Devdas Menon ñ Narosa Publishing House


7) Matrix Analysis of Framed Structures ñ Gere & Weaver- CBS Publications, Delhi

Lectures: 4 Hrs/week

**Unit I**
Introduction: Concept of hydro informatics scope of internet and web based modeling in water resources engineering.

**Unit II**
Introduction to multi criterion decision support system - Components for modeling software.

**Unit III**
Introduction to simulation: Different simulation techniques - Applications of simulation techniques in hydraulics.

**Unit IV**
Introduction to artificial neural networks:
Networks and its training - Back propagation algorithm, conjugate gradient algorithm, cascade correlation algorithm, applications of ANN in WRE.

**Unit V**
Genetic algorithm (G. A.): Concept, basic principle of GA, working principle of GA.
Coding, fitness function, GA. Operations, reproduction, cross over mutation, applications of GA, in WRE.

**Reference Books**
   P.McGraw Hill N.Y.
4. Machine Learning Neural Networks, Genetic Algorithm & Fuzzy system - Adeli H. & Hung
   S.L. John Wiely & Sons inc. N.Y.
Section I – TQM

Unit I

Unit II
a) Difference between, quality control, quality assurance, total quality control and total quality management (TQM)
B) Process based approach for achieving TQM. Study of ISO 9001 principles,

Unit III
TQM - Necessity, advantages. Six sigma as a tool in TQM. Supply chain management as a tool in TQM. Benchmarking in TQM. Kaizen in TQM. Defects in construction and measures to prevent rectify defects.

Section II - MIS

Unit IV
Introduction to Management Information systems (MIS)
Overview, Definition. MIS and decision support systems, Information resources, management subsystems of MIS.

Unit V
Management information system structure based on management activity whether for operational control, management control or strategic planning.
Unit VI

a) Survey of information systems technology w.r.t hardware, software, communications technology, data processing, Information processing.

b) Concepts of information, planning and control, Information based support systems. Development of an MIS for a construction organization associated with building works.

Reference Books

1. Management -Principal, process and practices by Bhat - Oxford University Press.
2. Financial management by Shrivastava- Oxford University Press
5. Total Engineering Quality Management - Sunil Sharma - Macmillan India Ltd.
Unit I

Introduction to earthquakes:
Geology of earth, configuration of tectonic plates in a globe, influence of Geology on earthquake, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity, scales, seismic zoning of India, seismic coefficients for different zones, Natural disasters, mitigation and social aspects.

Lessons from past earthquake: - Study of damages caused due to past, earthquakes in/ outside India and remedial measures.

Unit II

Theory of vibrations:
Vibrations - definition, causes, classifications. Single Degree of Freedom systems (SDOF) - free, forced, damped, un-damped vibrations. Introduction to Multi-degrees of Freedom systems (MDOF) - derivations of related equations and solutions to two degree and three degree of freedom systems.

Unit III

Seismic design of RC structure:
Unit IV

Type of forces generated due to earthquake, effects on different types of foundation, design of RCC isolated footing for earthquake loading, liquefaction, causes and its remedial measure.

Unit V

Introduction of different control systems:

Passive control: base isolation and active control: bracing system, TMD etc and some latest invention.

Unit VI

Restoration and retrofitting:
Evaluation of existing buildings, aging, weathering, development of cracks, improper load Path, asymmetry, materials and equipments for restoring and retrofitting, methodology of retrofitting for walls, slabs roofs columns, foundations etc. for buildings in stones, bricks, RCC.

Notes: Every design should confirm to latest versions of IS 1893, 4326, 13920, 13827, 13828, 13935

Reference Books

1. Earthquake resistance design of structure by Duggal- Oxford University Press.
2. Dynamics of structure by Clough R.W. and Penzin J. McGraw Hill Civil Engineering Series
3. Dynamics of structure by Anil Chopra, Prentice Hall India Publication
4. Dynamics of structure by Mario Paz, CBSPD Publication
5. Earthquake Resistant Design by David J. Downik, John Wiley and Sons Publication
6. Earthquake Tips NICEE, IIT, Kanpur
7. Elements of Earthquake Engineering by Jaikrishna and Chandarsekaran.
9. Introduction to Structural Dynamics by John M. Biggs
10. Mechanical Vibrations by V. P. Singh
11. Relevant Latest Revisions of IS codes.
ADVANCED CONCRETE TECHNOLOGY

Teaching scheme:
Lecture: 4 Hrs/week.

Examination scheme:
Paper : 100 Marks
Duration : 3Hrs.

Unit I
Cement and its types: general, hydration of cement, water requirement for hydration, alkali aggregate reaction.
Aggregate: grading curves of aggregates.
Concrete: properties of concrete, w/c ratio, w/b ratio, gel space ratio, maturity concept, aggregate cement bond strength.

Unit II
Light weight concrete, ultra light weight concrete, vacuum concrete, mass concrete, waste material based concrete, shotcreting, guniting, sulphur concrete and sulphur infiltrated concrete, jet cement concrete (ultra rapid hardening), gap graded concrete, no fines concrete, high strength concrete, high performance concrete and under water concreting.

Unit III
Design of high strength concrete mixes, design of light weight aggregate concrete mixes, design of flyash cement concrete mixes, design of high density concrete mixes
Advanced non-destructive testing methods: ground penetration radar, probe penetration, pull out test, break off maturity method, stress wave propagation method, electrical/magnetic methods, nuclear methods and infrared thermography, core test.

Unit IV
Historical development of fibre reinforced concrete, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres and naturally occurring fibres. Interaction between fibres and matrix (uncracked and cracked matrix), basic concepts and mechanical properties: tension and bending.
Unit V
Properties of hardened frc, behaviour under compression, tension and flexure of steel fibres and polymeric fibres.

GFRC, SFRC, SIFCON—development, constituent materials, casting, quality control tests and physical properties.

Unit VI
Ferrocon, analysis and design of prefabricated concrete structural elements, manufacturing process of industrial concrete elements, precast construction, erection and assembly techniques.

Reference Books
1. Concrete technology by Santhakumar- Oxford University Press.
2. Concrete technology- A.M. Neville and Brooks
3. Properties of Concrete- Murdock.
5. Concrete Technology- M.S. Shetty.
Unit I
Design of cold formed light gauge steel sections subjected to compression- axial tension and flexure- composite roof deck system using light gauge section

Unit II
Design of perforated web beams such as castellated beams

Unit III
Limit state analysis and design of solid web gable portal frames- moment resisting bases and design of anchor bolts- concept of Pre engineering buildings.

Unit IV
Limit state design of flat slab and grid slab

Unit V
Limit state design of flat grid slab

Unit VI
Analysis and design of elevated water tank with multiple columns - analysis and design of staging subjected to earthquake forces, seismic coefficient method.

Term Work
1. Any one design project from section-I and one from section II
2. One full imperial size drawing sheet showing structural design details for each project.
   Computer assisted drafting for only one drawing of the project.
3. Two site visits, one for steel structure and other for RCC structure based on the contents of section I and section II respectively.

Note: unless otherwise stated, design should be based on latest I.S. codes 800, 801, 811, 875, 3370, 1893
Reference Books

1) Varghese, P. C.  Advanced Reinforced Concrete Design, PHI

2) Krishna Raju- Advanced Reinforced Concrete Design. CBSRD.

3) Shiyekar, M R.-Limit state design in structural steel । Prentice Hall of
    India Learning Pvt. Ltd. Delhi.

4) Ramakrishna, V. Arthur P. D., Ultimate strength Design for Structural Concrete,
    Pitman, London.

    PVG Prakashan, Pune.


7) Sinha and Roy, , RCC Analysis and Design . S. Chand and Co. New-Delhi


9) Punmia, B. C. and Jain and Jain, Comprehensive Design of Steel Structures, Standard
    Book House

Handbooks


11) ISI Hand book for structural engineers SP 6 (5): 1980

12) ISI Handbook for structural Engineers SP6 (2) : 1962 Steel Beams and plate girders.

13) ISI Hand book for structural engineers SP 6 (6) 1972. Application of plastic theory
    in design of steel structures
ADVANCED FOUNDATION ENGINEERING

Lecture: 4 Hrs/week.
Practicals: 2 Hrs/week

Examination scheme:
Paper : 100 Marks
Term work : 25 Marks
Duration : 3 Hrs.

Unit I
IS code provision in respect of subsoil exploration for dams, canals, tunnels, off shower structure, air ports bridges. IRC, provisions for exploration in respect of roads. Case studies of failures of foundation,

Unit II
Design of shallow foundations subjected to inclined loads. Design of Raft foundation on different types of soil. Design of combined and isolated footing based on field test including calculation of settlement. Introduction to softwares available for geotechnical design.

Unit III
Design of pile based on cyclic load test. Study of provision made in different IS codes related to deep foundation, various types of pile. Design of Racer piles & piles subjected to lateral load. Testing and Design of piles subjected to tensile loads.

Unit IV
Design of under reamed pile foundation subjected to tensile loads. Design of sand drains and stone columns.

Unit V
Study of various provisions made as per IRC and as per IS in respect of design of well foundation. Case studies of failure of well foundation.

Unit VI
Design and enabling structures like cofferdam, sheet piles, cellular cofferdam Rockfioll cofferdam.
Term Work

Term work will consist of

A) Any Five of following assignments

1) Comparative study of provisions made for the extent of exploration in IS, IRC codes adapted by Indian railways, and PWD
2) Detailed study of any two Geophysical methods of exploration
3) Computations of Bearing capacity and Settlement of a Shallow Foundation involving inclined loads.
4) Design of Pile foundations subjected to inclined load and Tensile load.
5) Design of Sand Drains.
6) Comparative study of provisions for well Foundation as per IS, IRC and code adapted by Indian railways.
7) Design of Cantilever Sheet Pile using free end or fixed end method.
8) Stability analysis of Cellular Cofferdam.

B) Computer Modelling

Design of any one type of Deep foundation using computer software

C) Site visit and Case study

1) One site visit to any important deep foundation and submission of report on the same giving details of design and construction.
2) Any one case study of failure of foundation from the published literature

A) Reference Books

1. Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Grawhill
2. Design Aids in Soil Mechanics and Foundation Engineering- Shenbagedh R Kaniraj, TATA Mc-Grawhill
3. Design of Foundation Systems- Nainan P Kurian, Narosa publication house
4. Foundation Design & Construction- M.J.Tamlinson, ELBS publication
B) I.S. Codes

IS: 1892-1979 "Code of Practice for Subsurface Investigation for Foundation"
IS: 6403-1981 "Code of Practice for Determination of B.C. of Shallow Foundation"
IS: 8009 (Part-1) 1976, "Code of Practice for Calculation of settlements of foundations"

C) Handbooks


D) e Resources

1. Website www.nptel.iitm.ac.in
**Teaching Scheme:**
- Lectures: 4 Hrs / week
- Practical: 2 Hrs / week

**Examination Scheme:**
- Paper: 100 Marks
- TW: 25 Marks
- Duration: 3 Hrs.

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## Unit I

**Introduction**

Importance of geological studies in engineering investigations. Precaution necessary to avoid misleading conclusions likely to be drawn while interpreting drilling data. Dependence of design on geological features of project site.

**Geology applied to civil engg. practices**

Case studies illustrating economics made possible by proper geological studies.

**Indian stratigraphy**

Engg. geology of major rock formations of India including Deccan Trap Basalts w.r.t. Introduction, Distribution and Engineering characteristics of Deccan trap

(8 Hrs)

## Unit II

**Subsurface explorations for water conservation Structures**

Strength & watertightness of Deccan trap rocks from foundation point of view. Physical properties such as compressive strength, water absorption. Effect of weathering & hydrothermal alteration on the engg. properties of rocks. Illustrative case studies.

**Remedial measures to treat geological defects:**

Foundation investigations during construction for determining the foundation treatment for adverse geological features and Correction of it. Various methods and measures to treat geological defects. Typical case studies.

**Erosion of tail channels:**

Erosion of tail channel as factor in selecting site for spillway and geological conditions leading to tail channel erosion. Case studies.

(8 Hrs)
Unit III

Geohydrological aspects of different rock formations


Geology of soil formation:

Residual & transported soils. Rock weathering conditions favorable for decomposition & disintegration. Influence of climate on residual & transported soils. Scarcity of sand in the rivers in the Deccan trap area. (8 Hrs)

Unit IV

Rock mechanics:

General principles of rock mechanics index properties of rock masses. Various laboratory testing methods. Mechanical properties of Rock Masses. Various systems of rock mass characterization such as R.M.R. and Q. system. (7 Hrs)

Geophysical techniques:

Basic principles of various methods, use of electrical resistivity method and application of it in civil engineering. (1 Hrs)

Unit V

Tunneling:

Variations in methodology of investigation for different types of tunnels, location, spacing, angles & depths of drill holes suitable for different types of tunnels. Difficulties introduced by various types of rock masses & unfavorable field characters. Measurement of discontinuities rock mass characterization using different methods as applicable for tunnels, bridges and slopes.

Bridges:

Investigation for bridge foundation, difference in objectives of investigation of dam foundation. Foundation settlements. Case studies.
Resource engineering
Deccan Trap basalts as construction material. Use of Deccan Trap rocks for different purposes. Recent developments in construction industry w.r.t. engineering geology. Study of case studies.

Role of geology in planning and development
Influence of geological factors upon urban development & planning, locating non-renewable resources and geothermal energy.

Earthquakes and tectonics:
Zoning of earthquakes with special reference to Seismicity in Maharashtra. R.I.S.

Practical Work / Term Work

I) Study of Geological map of Maharashtra state and India (2 Practicals)

II) Interpretation of drill hole data
Logging of drill cover, preparation of Litho logs & interpretation of drill data. Preparing geological cross sections from drillhole data & using them for designing of civil engineering structures representing following case studies.
1. Dipping sedimentary formation
2. Faulted region
3. Folded region
4. Locating spillway on Igneous rocks
5. Tunnels in Tectonic areas
6. Tunnels and open cuts in non-tectonic areas

III) Use of electrical resistivity method for determining depth of bedrock. (1 Practical)

IV) A compulsory guided tour to study geological aspects of an engineering projects & writing a report based on studies carried out during visits to civil engineering projects.
The practical journal will be examined as term work
Reference Books

4. Dr. Dobbrin - Introduction to Geophysics
5. Goodmann Ī Engg. Geology
10. Environmental Geology by Waldiya

Handbooks

2 Tunneling India ’94, Ī Central Board of Irrigation and Power Ī New Delhi

4 Handbook of Geological terms, geology and Physical Geology, David page, University of Michigan. USA
5 Handbook of Geology in Civil engineering, Robert Fergussion , Legget, Mc-Graw hill,
6. Geotechnical Engineering handbook, Robert day, Mc- Graw hill,
   ISBN 0-07-137782-4
I. S. Codes
1) IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I and II.

e- Resources
1. www.ebd.co.in/undergraduate/eng
2. www.library.iisc.ernet.in
3. www.iitb.ac.in
4. www.nptel.iitm.ac.in
ADVANCED ENVIRONMENTAL MANAGEMENT

Teaching Scheme:
Lecture: 4 Hrs/week
Practicals: 2 Hrs/week

Examination Scheme:
Paper: 100 Marks
TW: 25 Marks
Duration: 3 Hrs.

Unit I

Unit II
Environmental Management Acts related to environmental protection:- Air, Water, Soil and hazardous waste Water act 1974 (Prevention and control of pollution)
Air act 1981 (Air pollution prevention and control of pollution)
Hazardous waste management handling rules -1989

Unit III
Air pollution management

Unit IV
Waste Water Management

Unit V
Solid Waste Management:- Municipal, Hazardous and Biomedical

Unit VI
EIA (Environmental Impact Assessment) and Auditing

Term Work
Term work shall consist of detailed report on any two of the chapters from the following
(a) Industrial water pollution control technologies
(b) Anaerobic treatment of industrial process wastewaters
(c) Industrial water pollution control - Applications
(d) Industrial waste water treatment ï Principles
(e) Pollution control legislations and their implementation
(h) Particulate emission control technology
(i) Global trend in industrial pollution control
(j) Pollution control and waste management in sulphuric acid and super phosphate plant
(k) EIA for any one (Thermal power station, water resources project or express highways)
(l) Application of GIS/remote sensing in environmental planning and management.
(m) Air quality management for industries
(n) Hazards wastes—Definition Classification and Treatment

Note: Oral will be based on the report produced by each student on the above articles.

Reference Books

2. Anti pollution Acts (3) and commentaries published therorem.
3. Constitution of India [Referred articles from part-III part-IV and part-IV A]
5. P. Leelakrishanan, Environmental and the last (Bullorthworths, Latold edn.)
6. Basic environmental technology: Jerry; A. Nathanson.
9. ISO 14004-Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004:1996 (E)).
10. ISO 14001: environmental management systems:Specification with guidance for use (ISO 14001:1996b(E)) (International organization for standardization-Switzerland)

[Note: - Declarations, comments, cases and research articles published from time to time will be recommended by the concerned teachers]
III CONSTRUCTION MANAGEMENT

Teaching Scheme:
Lectures: 4 Hrs / week
Practical: 2 Hrs / week

Examination Scheme:
Paper : 100 Marks
TW : 25 Marks
Duration : 3 Hrs.

Unit - I

Overview of construction sector
Role of construction industry in infrastructure development, components of infrastructure sector, construction industry nature, characteristics, size, structure, role in economic development, construction management necessity, applications, project management consultants role, types, selection and appointment process, project overruns and means to combat them, project monitoring and reporting systems, managerial correspondence and communications, generation and identification of project investment opportunities.
(* At least 2 lectures of 2 hours duration by experts from field are to be conducted on above topics) (8 Hrs.)

Unit - II

Construction scheduling, work study and work measurement (8 Hrs.)

Construction scheduling
Construction project scheduling purpose, factors affecting scheduling, time as a control tool, work breakdown structure, project work breakdown levels, line of balance technique, repetitive project management (3 Hrs.)

Work study and work measurement
Definition, objectives, basic procedure of work study, symbols, activity charts, string diagrams, time and motion studies. (5 Hrs.)

Unit - III

Labour laws and financial aspects of construction projects (9 Hrs.)

Labour laws
Need and importance of labour laws, study of some important labour laws
Financial aspects of construction projects
Capital investments: importance and difficulties, means of finance, working capital requirements, project cash flow projections and statements, project balance sheet, profit loss account statements (6 Hrs.)

Unit - IV
Elements of risk management and value engineering (8 Hrs.)
Risk management
Introduction, principles, types, origin, risk control, use of mathematical models: sensitivity analysis, break even analysis, simulation analysis, decision tree analysis, risk identification, analysis and mitigation of project risks, role of insurance in risk management. (5 Hrs.)

Value engineering (3 Hrs.)
Meaning of value, value analysis, value engineering and value management, energy resources, consumption patterns, energy cost escalation and its impact.

Unit - V
Materials management and human resource management (8 Hrs.)
Materials management
Materials flow system, role of materials management in construction management and its linkage with other functional areas, vendor networking, buyer-seller relationships, eoq model and its variations, material codification and classification, concept of logistics and supply chain management, role of ERP in materials management ñ material resource information systems. (5 Hrs.)

Human resource management
Unit - VI
Intelligence technique

Basic terminologies and applications in civil engineering
(a) Artificial neural network  (b) Fuzzi logic  (c) Genetic algorithm  (8 Hrs.)

Term Work
1. Site Visit to a Construction project to study following documents and preparing a report i
   a. Project Cash Flow Analysis.
   b. Project Balance Sheet.
   c. Work Break Down Structure.
3. Assignment on Work Study on any two Construction Trades.
4. Assignment on EOQ Model and its variation.
5. Assignment on application of AI techniques in Civil Engineering
6. Seminar on any one topic from above syllabus.

Reference Books
8. Artificial Neural Network Veganarayanan Prentice Hall.
1. Fuzzi Logic & Engg Applications – Ross


e-Resources

1. ERP Software–Builders Management Software

2. Project mates Construction Software
Unit I

**Introduction**: World water resources, water resources in India, water as finite resource, variability of water in time & space, history of water resources development, water infrastructure-problems and perspectives, present institutional framework for water management. (3Hrs)

**Water laws**: Constitutional provisions, National Water Policy, riparian rights / ground water ownership, prior appropriation, permit systems, acquisition and use of rights, scope for privatization. (3Hrs)

**Economics of water**: Water as economic good, intrinsic value, principles of water pricing & water allocation, capital cost, opportunity cost, internal rate of return, benefit cost analysis, principles of planning and financing of water resources project. (4Hrs)

Unit II

**Probabilistic and statistical methods**: statistical parameters, mean, mode, median, standard deviation, curtosis, probability, random events, random variable, functions of random variables, moments and expectations, common probabilistic distributions (normal, lognormal, poission, extrem value, log-pearson etc.) estimation of parameters, goodness of fit tests, regression and correlation analysis. (4 Hrs)

**Systems engineering**: Systems Engg. concepts, optimizing techniques, conventional (LP, NLP, DPÉ) and evolutionary (ANN, fuzzy logic, genetic algorithm), simulation, applications of soft computing techniques for water resources planning and management. (6 Hrs)

Unit III

**Flood management**: causes of floods, structural and non-structural measures, mitigation plan, flood damage assessment, use of geoinformatics,
Basin scale hydrology: Estimation of surface water, estimation of ground water draft/recharge import/export of water (interbasin water transfer), recycling and reuse, storages. (5 Hrs)

Demand and supply based management: Consumptive & non consumptive demands, irrigation demand estimation, water utilization, irrigation efficiency, water management in irrigation sector, demand estimation in hydro/thermal/nuclear power sector, estimation & forecasting of water demands of domestic & industrial sector, navigation and recreational water demands (5 Hrs)

Unit V

Environmental management: protection of vital ecosystem, water requirements for environmental management, aquaculture, minimum flows, water quality management for various uses. (5 Hrs)

Social impact of water resources development: direct/indirect benefits, employment generation, industrial growth, agro-industry, enhanced living standards, education & health, co-operative movement, management of rehabilitation & resettlement, control of water logging, salinity, & siltation of storages. (5 Hrs)

Unit VI

Basin planning & management: Perspective plan for basin development & management, Decision support system for Integrated Water Resources Management (IWRM), use of Geoinformatics, Artificial Neural Networks in water resources planning, development & management (6 Hrs)

Reference Books

   Tata McGraw Hill
10. J.R. Benjamin and C.A. Cornell; Probability statistics decisions for Civil Engineering,
    McHill 1975.
14. Water shed Management ‒ B.M. Tideman
15. Watershed Shed Management V.V. Dhrava Narayana, G Sastry, U.S. Patnaik.
17. T.M. Lillesand and R.W. Kiefer, Remote Sensing and Image Interpretation,
18. ANN in Hydrology; Govinda Raju & Ramachandra Rao; PHI
Unit I

Transport System Planning:
Transport policy, process, and types of surveys. 0D matrix. Travel demand forecasting trip generation, modal spilt analysis, trip distribution, route assignment analysis, Transport Networks, network flow analysis.

Unit II

Urban Transport Technology:
Classification, mass and rapid transit system, Introduction to Intelligent Transportation System (ITS), Public Transport policy, intermediate. Introduction to BRT, Mono rail, sky bus, metro projects, grade separated interchanges such as flyovers, underpasses, overpasses, concept of Integrated Inter Model transit system.

Unit III

A. Transport Economics & Financing:
Vehicle operations cost, running cost, pollution cost, value of travel time, road damage cost, congestion cost, accident cost economic evaluation, various economic studies. Transportation plans î Benefit cost method, Net present value method, First year rate of return method, Internal rate of return method & comparison of various methods. Pavement management systems.

B. Highway Financing: Pay as you go method, credit financing, private financing, BOT, BOOT, dedicated road funds, road pricing, tolls, private provisions, advantages & limitations.

Unit IV

Traffic Systems:
Traffic impacts, traffic studies, level of service, traffic analysis process, basic traffic theory, intersection studies, turning movements, flow, delays, and queuing, signal design, grade separated intersection, parking studies, Traffic generation and parking, parking
Unit V

Study of flexible pavement:
Highway pavements and airport pavements, Flexible pavements studies, performance studies, surface, surface characteristics of pavements, profile measurements, pavement unevenness, skid resistance, its measurements, IRC, AASHTO guide to design of pavement, pavements failure, maintenance strategy Freezing of soil, B.C. soil, desert soil etc. Strengthening of pavement in Benkelmen beam method. Distresses in Pavements.

Unit VI

a) Study of rigid pavement:
Concept of rigid pavement, comparison of rigid pavement over flexible pavement, Stress distribution in layered media, one and two layered system, joints in rigid pavement, longitudinal construction joints, design as per IRC guidelines, design of joints, dowel bars, temperature reinforcement, pavement failure, maintenance strategy strengthening of rigid pavement, types of overlays, flexible over rigid, rigid over rigid, mechanization in pavement construction.
b) Overlay types and their design as per IRC.

Reference Books
1. Highway Engineering - Laurence I Hewes & Clarkson H Oglesby
3. The Design and Performance of Road Pavements - David Croney, Paul Croney.
6. Introduction to transport planning - M. J. Bruton.
8. Modern Construction Equipments's and methods- Frank Harries.
12. Introduction to Transportation Engg. and Planning in Morlok E K,

14. A course in Traffic Planning and design - Saxena Subhash, Dhanpat Rai & sons, Delhi

15. Traffic analysis (New technologies new solutions) - Taylor M P, Hargreen

   Pub. Co. New Delhi

HandBook


e-Resources

1) www.nptel.iitm.ac.in/courses/iitkanpur

2) www.cdeep.iitb.ac.in/nptel
ELECTIVE IV (OPEN ELECTIVE)

FINITE ELEMENT METHOD IN CIVIL ENGINEERING.

Teaching Scheme:
Lectures: 4 Hrs/week

Examination Scheme:
Paper: 100 Marks
Duration: 3 Hrs.

Unit I
Formulation of stiffness matrix, member approach for truss and beam element, node numbering, assembly of element equations, formation of overall banded matrix equation, boundary conditions and solution for primary unknowns, applications to truss and beam not involving unknowns more than three.

Unit II
Formulation for stiffness matrix using member approach for portal frame and grid elements, transformation matrix, applications to frame and grid not involving unknowns more than three.

Unit III
Theory of elasticity: Strain-displacement relations, compatibility conditions in terms of strain, plane stress and plane strain problems, differential equations of equilibrium, compatibility condition in terms of stresses, stress-strain relations in 2D and 3D problems.

Unit IV
Principle of minimum potential energy, formulation of stiffness matrix for truss element using principle of minimum potential energy, concept of finite element for continuum problems, discretisation of continuum, use of polynomial displacement function, Pascal’s triangle, element stiffness matrix for 1D axially loaded bar element and beam element, evaluation of stiffness matrix using variational principle.

Unit V
Displacement function for 2D triangular (CST and LST) and rectangular elements, evaluation of stiffness matrix using variational principle, 3D element such as tetrahedron and hexahedron.
Unit VI

Use of shape functions, Area co-ordinates for CST element, Iso-parametric elements in 1D, 2D and 3D analysis, Jacobian matrix, Formulation of stiffness matrix for 1D and 2D Iso-parametric elements in plane elasticity problem.

Reference Books

1) Nonlinear finite element analysis by Reddy- Oxford University Press.
2) Introduction to the Finite Element Method ŕ Desai & Abel, CBS Publishers & Distributors ŕ Delhi
9) Finite Element Analysis ŕ S.S. Bhavikatti, New Age International (P) Ltd.
(OPEN ELECTIVE) GEOINFORMATICS

Teaching Scheme:
Lecture: 4 Hrs/week

Examination Scheme:
Paper : 100 Marks
Duration : 3 Hrs.

Unit I

Concept of remote sensing: Electromagnetic energy, Interaction of EMR with Atmosphere and earth material, atmospheric windows, EMR spectrum, platform, sensor types, MSS.


Photogrammetry: stereoscopic vision, scale, relief displacement, parallax, vertical exaggeration.

Unit II

Satellite Remote Sensing: LANDSAT and IRS characteristics, products and FCC Interpretation Techniques, visual and digital in brief. Recognition of photoelements and terrain elements like size, shape, tone, texture, pattern, shadow etc.

Terrain analysis: Relief, landform, drainage pattern.

Unit III

Use of remote sensing in Lithology, structure and Geomorphology


Unit IV

Basic Concept of GIS, components, history and applications.

Hardware and Software requirements for GIS.

Map features, Scale, Resolution, accuracy and data base extent.

Unit V

Map projection and parameters: Geographical Coordinate system, types of projection and parameters, projection transformation and mapping in GIS.

Geospatial data models: Spatial and nonspatial data, VECTOR and RASTER models.

Unit VI

GIS Analysis: Digitalization, editing and structuring of map data, overlay analysis, Digital elevation and terrain model (DEM / DTM), buffer analysis and query analysis.
Introduction to GPS and their applications with limitations.

Applications of GIS in Civil Engineering.

Reference Books

1) Principles of geographical information system 2/e by Burrough-İ Oxford University press.
2) Remote sensing & GIS by Bhatta-İ Oxford University press.
3) Principle and Application of Photogeology by S. N. Pande
4) Photogeology and Regional mapping by J. A. E. Allum
5) Remote sensing and Image Interpretation By Lilley Sand
6) Photogeology by Miller and Miller
Unit I
Energy Resources – Planning and Potential
Power resources – Conventional and Nonconventional, Need & advantages, Hydrological analysis, Hydropower development in India, Hydropower potential.

Unit II
Hydropower Plants
Classification of hydropower plants - Run of river plants, Storage or Valley dam plants, Pumped storage plants, Introduction to micro hydro, Base load and Peak load plants, advantages & disadvantages, Components of hydropower plants.

Unit III
Load Assessment
Estimation of electrical load on turbines. Load factor, Plant factor, peak demand and utilization factor, load duration curve, Prediction of load.

Unit IV
Powerhouse
Types of Powerhouses, Typical layout of powerhouse, Components, Power plant equipments, Instrumentation and control.

Unit V
Turbines
Selection, Classification, Principles and design of impulse & reaction turbines, Governing of turbines, Water hammer, Surge tanks, Draft tubes, Cavitation.
Unit VI

Economics of Hydroelectric Power


Reference Books

1. Water Power Engineering – M. M. Dandekar and K. N. Sharma
2. Handbook of Hydroelectric Engineering – P.S. Nigam
4. Hydropower Resources in India – CBIP
Unit I
Physical unit process, Application, process and design parameters for activated carbon filtration for color and odour removal, ultra filtration, reverse osmosis, electro-dialysis for removal of colloidal and dissolved solids.

(8 Hrs)

Unit II
Chemical unit process Precipitation with alum, lime and ferrous sulphate for removal of phosphates, iron and heavy metals etc. chemical oxidation with peroxide and ozone for reduction in COD and color removal.
Biological process
Wetland treatment root zone cleaning system

(8 Hrs)

Unit III
Activated sludge process
Moving bed bioreactors, membrane reactor with submerged membrane, cyclic reactor, Nitrification and denitrification by aerobic and anaerobic process
Use of biological process for the removal of toxic chemicals like cyanides, phenols, heavy metals etc. Recycling of treated sewage after tertiary treatment

(8 Hrs)

Unit IV
Recycling and reuse and recovery
Introduction to 3 R principles to convert waste into wealth
Assimilative and supportive capacity of nature
Different methods of 3R principle to convert waste into wealth
Prohibitive factors for implementing 3R techniques
Cost benefit analysis of 3R principle
Use of waste water for irrigation (Specifications of waste water for irrigation, soil and crop, selection, preventive measures and health aspects).
Reuse of sewage in residential complexes
Biogas recovery for high strength waste (Whey, spent wash, black liquor).

Recovery of metals in electroplating, recovery of ammonia in urea manufacturing, recovery of plastic, paper and metal from MSW.

(8 Hrs)

Unit V

Introduction to the concept of zero discharge
Zero discharge technology based on 3R principle based on pulp and paper industry
Clusters of industries based on waste products in sugar cane processing
Case studies- Zero discharge of solid waste from residential complex

(8 Hrs)

Unit VI

Sorption mechanism – Theory of adsorption, design of adsorption column, using BDST model
Standard related to solid waste from residential complex.
Water requirement of various industries such as textiles, automobiles dairy and food industry, pharmaceutical industry.
Pollution hazard of radioactive materials
Introduction to green processes in the industries.

(8 Hrs)

Reference Books

1) Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication.


   of India.
e - Resources:

1) http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.

2) http://cpcb.nic.in

3) http://moef.nic.in
1 008  ELECTIVE IV

STATISTICAL ANALYSIS & COMPUTATIONAL METHODS IN CIVIL ENGG

Teaching Scheme:
Lectures: 4 Hrs/week

Examination Scheme:
Paper : 100 Marks
Duration : 3 Hrs.

Unit I

Statistical methods
Introduction, collection, classification and representation of data, measures of central value (mean, median mode), measures of dispersion, sampling.

Unit II

Various distributions
Binomial, poisson, normal, test of hypothesis, chi-square test

Unit III

Correlation analysis, regression analysis.
Coefficient of correlation, probable error, single and multiple regression, curve fitting, Interpolation and extrapolation

Unit IV

Optimization techniques

Unit V

Different numerical methods

Unit VI

Numerical Integration
Need and scope, trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Gauss Quadrature method.
2. Numerical Methods – E Balagurusamy
Unit I

**Estimating:** Definition, importance of quantity surveying for civil engineer. Purpose, type of estimates, data required for estimates. Items of work, description of an item of work, unit of measurement & principles deciding the units, mode of measurement of building works. Abstracting, bill of quantities. Provisional & prime cost items, contingencies, establishment charges, centage charges, Schedule of rates (D. S. R.)

**Approximate Estimate:** Definition, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation & water supply & sanitary engineering, electrical works.

Unit II

**Taking out quantities:** P.W.D method and centre line method of taking out quantities. Procedure of taking out quantities for different assignments in term work, using IS 1200 rules.

Unit III

**Specifications:** Definition & purpose, types, standard specifications- Red book. Legal aspect. Drafting detailed specifications with reference to materials, quality, workmanship, method of execution, mode of measurement and payment, for major items like stone/brick masonry, plastering, ceramic tile flooring, R.C.C. work.

**Analysis of rates:** Factors affecting cost of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Task work - definition & factors affecting task work. Analysis of rates of items mentioned in the specifications above.

Unit IV

**Valuation of Properties:** Purpose, nature of value, price, cost and value, types of value. Factors affecting value of property. Concept of free hold and lease hold property.
Methods of Valuation of Building

Land & building basis, Rental basis, Reproduction & replacement cost basis. Belting of land.

Unit V

Methods of Executing Works: PWD procedure of execution of work, Administrative approval, budget provision, Technical Sanction, Different methods of execution of minor works in PWD, like piecework, rate list, day work, daily labour.

Introduction to registration as a contractor in the P.W.D.


Unit VI


Conditions of contract: General and Specific conditions. Condition regarding EM, SD, time as an essence of contract. Important conditions regarding addition, alteration, extra items, testing of materials, defective work, subletting, powers delegated to Engineer in-charge regarding the above aspect, defect liability period, retention money, interim payment or running account bills, advance payment, secured advance, final bill. Settlement of disputes viz. dispute resolving board, arbitration, concept of partnering. Liquidated damages, termination of contract.
Term Work

and PWD method for a load bearing structure or for an industrial shed.

1. Estimating quantities using C-L and PWD method for a load bearing structure or for an industrial shed.


3. Detailed estimate of roadwork with cross slope / railway track / runway.

4. Working out quantities of steel reinforcement for a slab, a beam, a column, a column footing and preparing bar bending schedule.

5. Estimating quantities for any one of the following:-
   a. House drainage & water supply arrangement
   b. **Formwork items in a RCC structure.**
   c. **Pipe culvert or slab culvert.**
   d. Septic tank with soak pit.

6. Drafting detail specification of any two items and working out their rates using market prices.


8. Preparation of draft tender notice and collecting minimum 3 tender notices of Civil Engineering works.

**Note:** Any one of the above assignment should be done using estimating and costing software.

**Oral:** Oral shall be based on term work: Question paper shall be based on theory as well as term work.

**Reference Books**

1. Estimating and Costing in Civil Engineering: Theory and Practice
   By: B.N Dutta Published By: S. Dutta & Company, Lucknow.

2. Estimating, Costing Specifications & valuation in Civil Engineering
   By: M.Chakraborty Published By: Author.

3. Estimating and Costing By: G.S.Birdie

4. Estimating and Costing By: Rangwala Published By: Charotar Publishing House, Anand

5. Civil Engineering Contracts & Estimates By: B.S.Patil Published By: Orient Longman Ltd. Mumbai.
Handbooks


Codes

2. D.S.E: District Schedule of Rates

E - Resources

1. nptel.iitm.ac.in
SECTION I  HIGHWAY ENGINEERING

UNIT I

Introduction:
Role of transportation, scope of road transportation, highway development in India. Necessity of highway planning and development plans e.g. Bombay plan, Lucknow plan.

Classification of road:
Classification of roads, road patterns, planning surveys and preparation of master plans based on saturation system, determination of road length by 3rd road development plan.

Traffic engineering:
Traffic characteristics- road user characteristics, vehicular characteristics (only name and significance)
Traffic studies- name of various studies and their uses, accident studies- objectives, causes of accident, condition and collision diagram, and measures for the reduction in accidents. Traffic regulation and control devices- traffic signs, traffic signals (types merits and demerits) road markings. Traffic islands, types of road intersections (sketch merits and demerits). Parking facilities.

UNIT II

Highway alignment:
Basic requirements of an ideal alignment and factors controlling it, engineering survey for highway location, special requirements for hill roads,

Geometric design and traffic engineering:
metric design, cross sectional elements, sight distance overtaking sight distance, overtaking zones with irc recommendations, attainment of super elevation, radius of curves, methods of introduction of extra widening, widening of pavement on horizontal curves, horizontal transition curves- objects, necessity, types of transition curves, length and shift of transition curves. Design of vertical alignment, gradient and its type, irc recommendations, grade compensation on horizontal curve, vertical curves: - crest and sag curves, types of summit curves, length of summit curve for ssd and osd. requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria.

**Highway drainage:**
Importance of highway drainage, subsurface and surface drainage systems, scope of arboriculture for highway.

**Unit III**

**Highway materials:**
Importance and properties of sub-grade, pavement component materials. Tests on aggregates. Bitumen, types--cut back tar emulsion and tests, modified binders, bitumin mix design by marshall stability test, viscosity based gradation of bitumen

**Pavement design:**

**Construction:**
Construction process of WBM, WMM, GSB. Introduction to bituminous works such as prime coat tack coat seal coat MPM, AC or BC, BM, DBM and primix carpet. Strengthning of pavement types of overlays.
II Airport Engineering:

Unit IV

Introduction:
Advantages and limitations of air transportation. Aeroplane component parts and important technical terms.

Airport planning:
Aircraft characteristics, which influence judicious and scientific planning of airports, Selection of sites, survey and drawings to be prepared for airport planning.

Airport layout:
Characteristics of good layout, runway configuration, airport obstruction, location of terminal buildings, aprons and hangers. Zoning requirements regarding permissible heights of constructions and landing within the airport boundary.

Runways and taxiways:
Runway orientation, wind coverage, use of wind rose diagram, basic runway length, corrections for elevation, temperature and gradient as per ICAO and FAA recommendation. Airport classification by ICAO.

Unit V

Bridge engineering:
Introduction:
Classification of bridges, components of bridges, preliminary data to be collected during investigation of site for bridges, determination of discharge \( \text{i} \) empirical formula, direct methods, economical span, afflux, HFL, scour depth and clearance, locations of piers and abutments, factors influencing the choice of bridge super structure, approach roads.
loads, forces, stresses coming on bridges, IRC load specification, requirements of traffic in the design of highway bridges

Substructure:
Abutment, Piers, and wing walls with their types based on requirement and suitability.

Unit VI

Types of bridges

Various types of bridges:
a) Culvert: Definition, waterway of culvert and types.
b) Temporary bridges: Definition, materials used brief general ideas about timber, floating and pantoon bridges.
c) Movable Bridges: Bascule, cut boat, flying, swing, lift, transporter and transverse bridges, their requirement and suitability.
d) Fixed span bridges:
   Simple, continuous, cantilever, arch, suspension, bowstring girder type and rigid rame and cable stayed bridges, materials for super structure.

Bearing:
i) Definition, purpose and importance. Types of bearings with their suitability,
ii) Introduction to different techniques of erection of bridge super structure and maintenance of bridges.

Practicals:
A set of experiments based on following topics:

1. Aggregate Testing:  
   1. Aggregate Impact  
   2. Aggregate Crushing Strength  
   3. Los Angeles Abrasion Test  
   4. Flakiness index and Elongation index under shape Test
5. Specific Gravity and Water absorption

6. Stipping Value

7. Soundness

2. Bitumen test: (Any Six)

1. Penetration
2. Ductility
3. Softening Point
4. Flash Point & Fite Point
5. Specific Gravity
6. Bitumen extraction test
7. Marshall Stability

3. Technical visits to Bridge site/Airport AND Hot mix Plant

Reference Books

1) Highway engineering ì S.K. Khanna and C.E.G. Justo, Nem Chand and Broththers, Roorkee (Uttaranchal)
2) A Course in Highway Engineering ì S.P. Bindra, Dhanpat Rai and Sons, Delhi.
3) Principles of Transportation Engineering ì G.V. Rao Tata MacGraw Hill Publication
4) Highway Engineering ì Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
5) Principles and practices of Highway engineering ì Dr. L.R. Kadiyali, Khanna Publishers Delhi.
7) Highway and Bridge Engineering ì B.L. Gupta, Amit Gupta standard publishers Distributors, Delhi.
8) Principles and practice of Bridge Engineering ì S.P. Bindra, Dhanpatrai and Sons, Delhi.
9) Bridge engineering ì Rangawala, Charotar Publishing House, Anand ì 388 001.

13) Airport Engineering — Rangawala, Charotar publishing House, Anand 388001 (Gujrat)

**Codes**

1) I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I to V

2) I.R.C. 58, IRC37

3) Specifications for Road and Bridge works (MORTH)-IRC New Delhi Specifi

**Hand Book**

1) Handbook of Road Technology_Lay M.G., Gorden Breach Science Pub.Newyork

2) Civil Engineering Handbook-Khanna S.K.

**e - Resources**

1) www.nptel.iitm.ac.in/courses/iitkanpur

2) www.cdeep.iitb.ac.in/nptel
Teaching Scheme:
Practicals: 2 Hrs/week

The project work shall consist any one of following nature in civil engineering related subjects
1. Experimental investigation.
2. Software development.
3. Cost economic analysis.
4. Case study with own design.
5. Working model design and fabrication.
It is mandatory to present a seminar and submit preliminary project report based on worked done in first semester for the grant of semester I

The report shall contain finalization of topic, literature survey, planning schedule/flow chart for completion of project. The report shall be typed or printed and hard/spiral bound.

The project work to be taken up individually or in groups. The group shall not be of more than five-six students. The references shall be mentioned at the end as per universal standards as mentioned in any international journal of professional body.

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401006 Project Work (Semester II)

Teaching Scheme:
Practicals: 6 Hrs/week

Examination scheme:
Termwork: 100 Marks.
Oral: 50 Marks

The Project Work shall be in continuation of Semester I. It shall contain methodology, results, analysis & discussion of the work carried out and the conclusions with future scope.

The report of 1st and II nd semester work shall be typed or printed in standard format as mentioned in Annexure A.

Oral and term work shall be based on the project work carried out by the students and jointly examined by an internal and external examiners appointed by University of Pune, Pune at the end of Semester II.
A – Format of project report

Sequence of pages

Front Cover Page (sample enclosed at the end)
Blank Paper
Front Page (Same as front cover page)
Certificate (sample enclosed at the end) ii
Acknowledgement iii
Synopsis iv
Contents v
Notations vi
List of Tables vii
List of Figures viii
List of Graphs ix
(Give page number in Roman letters as shown above.)

CHAPTER 1 INTRODUCTION 1-10 (say)
(This consists of introduction of the subject, area etc.- problem statement and description- need- objectives- its relevance to the field-shortcomings-scope of the project work- outline of the report.)

CHAPTER 2 LITERATURE REVIEW 11-25 (say)
(It shall include theoretical support, details regarding work done by various persons, methods established, any new approach. It should preferably highlight the development in the field of research chronologically as reflected from books, journals etc.)

CHAPTER 3 THE METHODOLOGY AND INVESTIGATIONS 26-85 (say)
(It shall consist of data collection, survey, field work, lab work, analysis, design, software development etc. in details)

CHAPTER 4 RESULTS, DISCUSSIONS & CONCLUSIONS 86-110 (say) 
(It shall include detailed discussions on results obtained, cost economics, scope for implementation on field. )

CHAPTER 5 CONCLUSIONS 110-115 (say)

References

Bibliography
(The references and bibliography shall include name of author/code/book, title of paper/code/book, name of the journal, month & year of publication, volume number/ISBN number, page number x-y. The references and bibliography shall be as per universal standards as mentioned in any international journal of professional body.)
1) Report shall be typed on A4 size on Executive Bond paper with spacing 1.5 on one side of paper.
   Left Margin : - 37.5 mm
   Right Margin : - 25 mm
   Top Margin : - 25 mm
   Bottom Margin : - 25 mm

2) Give page number at bottom margin at center

3) Size of Letters
   Chapter Number: - 12 font size in Capital Bold Letters
   Chapter Name: - 12 Font size in Capital Bold Letters
   Main Titles (1.1, 3.4 etc):- 12 Font size in Bold Letters- Sentence case.
   Sub Titles (1.1.4, 2.5.3 etc):- 12 Font size in Bold Letters- Sentence case.
   All other matter: - 12 Font size sentence case

4) No blank sheet be left in the report

5) Figure name: - 12 Font size in sentence case-Below the figure.

6) Table title - 12 Font size in sentence case-Above the table.

Binding details

Brown / maroon color with golden embossing for project report.
Black color with golden embossing for hard bound or else spiral bound for seminar report.
Project Report

On

( Title of the project )

In the partial fulfillment of the requirement for
Bachelor Degree in Civil Engineering

Submitted by

ABC   ( Exam. No.)
DEF   ( Exam. No.)
GHI   ( Exam. No.)

Guided by

Prof. XYZ

DEPARTMENT OF CIVIL ENGINEERING
NAME OF COLLEGE
University of Pune
20 - 20
This is to certify that Mr./Ms. __________________ has satisfactorily carried out the investigation/experimentation and completed the project work entitled ______________________.

This work is being submitted for the award of degree of Bachelor of Civil Engineering. It is submitted in the partial fulfillment of the prescribed syllabus of University of Pune, Pune for the academic year 2020.

Prof. X.Y.Z.
(Guide)

Prof. A.B.C.
(Head of civil engineering department.)

Prof. L.M.N.
(Principal)

External Examiner
F. E. Civil Engineering (2008 Course):

107001 & 107008: Engineering Mathematics I & II:

By covering the course in Engineering Mathematics, the student will be able to:

**Objectives:**
- Know the basics of Matrices, Complex Numbers & their Applications, Differential Calculus, Partial Differentiation and Applications, the Maxima and Minima of Functions of two variables, continuity and derivative of a single variable and their applications to engineering problems, the various methods of Absolute and Conditional Convergence, Range of Convergence,
- Understand their engineering application. Solve related simple numerical problems, which will help them to understand the subject.

107002 & 107009: Applied Science I &II:

**Objectives:**
- To impart the basic principles of light, processes of light in its propagation and to understand Interference, Diffraction and Polarization of light.
- To make them aware of different paths, trajectories of electron in different fields (Electric & Magnetic), Electrostatic lens, Magnetic lens for focusing electrons in different instruments to understand how to separate isotopes, Bainbridge mass spectrograph.
- Also to demonstrate knowledge of production of ultrasonic sound by understanding magneto striction and Piezo electric oscillator, Applications of it in day to day life as well as in research areas and give basic information of nuclear energy for both merits & demerits of it. Semiconductors and superconductors are the base of Electronics & Material Science and hence students get acquainted by its knowledge and can apply it in most of the engineering branches.
- To impart basic methods of production of quantum dots using the nano material and their properties and applications. Also, one of the important devices in today's world is the LASER and it is taught thoroughly to impart its complete knowledge for construction and application of it.

**Outcomes:**
- In order to test their knowledge towards learning outcomes- experimental work, assignments, test papers are assigned to students and evaluated and are given back.
- The students will be able to apply the principles studied in Applied Physics to different type of applications in medical, engineering, research and also in day-to-day life.
- An engineering student will learn different types of forces acting on a particle/body and evaluate the motion of that particle/body. Hence, it will be very easy for them to determine different properties of certain body.
Students will be able to understand propagation of light through Fiber Optical wire, which helps them to get an idea of Communication, Transmission and Reception of a signal.

- Design solar wings for deep Space vehicles.
- To understand production and application of material in nano scale.
- To understand, simplify and analyze the problems related with mechanics, thermodynamics, and electronics and electrical.
- Thus Applied Physics is the key subject for all the engineering branches.

### 110003: Fundamentals of Programming Languages:

**Objectives:**
- To learn and acquire the art of computer programming
- To know about some popular programming languages and how to choose a programming language for solving a problem using a computer. To learn programming in C

### 103004: Basic Electrical Engineering:

**Objectives:**
- The student should understand the basic principles of D.C. Circuits & theorems, various types of Batteries & application, Electromagnetic, and Electrostatics.
- The student should be prepared to continue the study of the a.c. circuit, a.c. fundamentals.
- They should understand basics of Transformers & Polyphase ckt.
  - Student should be able to calculate efficiency of Transformer & under which condition we can get the maximum efficiency.

### 101005: Basic of Civil & Environmental Engineering:

**Objectives:**

**I. Preparation:**
- To produce engineering graduates who are introduced with the basics of Civil engineering.
- To produce engineering graduates who are introduced with all basic branches of civil engineering.
- To produce graduates who have Knowledge of Civil engineering.

**II. Core Competence:**
1) To learn the all basic branches and their practical application.
2) To learn the inter relationship of all branches engineering.
3) To study basic principles of surveying & different types of surveying.
4) To study modern equipments of surveying.
5) To study different types of construction materials such as cement, brick, concrete, steel etc.
III. Breadth
1) To train the students of engineering with all basic branches of civil engineering so that they can understand materials of construction, planning etc.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork.
2) To train the students to develop their carrier in execution of construction.
3) To produce engineering graduates, capable of involve in saving natural resources.
4) To crate the engineer having awareness of environment.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to perform all construction activity from foundation to final stage.
2) Engineers having the ability to improve the existing systems.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.

102006: Engineering Graphics I:

Objectives:
Students should be able to understand:
1. Various projection methods of drawing
2. Analysis of drafting principles for accurate drafting.
3. Drafting with softwares.
4. Freehand sketching of various standard m/c parts.
5. Various curves used in engineering.
In order to achieve PEOs following steps should be taken:
1. Practices are conducted.
2. Assignments are to be given.
3. Students will be able to analyze objects in 2dimension, 3 dimensions.
4. Students will be able to read the drawing, to draw object.
5 Students will be able to use various drawing software.
6. Drawing sheets are given.
101010 : Engineering Mechanics :

Objectives:

I. Preparation:

1) To produce graduates who have a strong foundation of scientific and technical knowledge and are equipped with problem solving, teamwork, and communication skills that will serve them throughout their careers.
2) To produce graduates who have the ability to pursue careers as practicing civil engineers.

II. Core Competence:

1) Learn vector algebra and the representation of vectors and their components, analytically and graphically, including representation of forces, moments, and couples as vectors in two- and three-dimensions.
2) Develop capacity for visualizing physical configurations and learn how trusses, frames, machines, and beams are modeled in order to analyze relevant external and internal forces.
3) Learn to isolate a body or a member of a frame or machine and apply all forces acting on the body (i.e. construct free body diagrams).
4) By conducting analyses of forces acting on frames, machines, trusses, and beams, learn how these entities support and transmit loads.

III. Breadth:

1) Solve for the resultants of any force systems
2) Determine equivalent force systems
3) Determine the internal forces in plane frames, simple span trusses and beams
4) Solve the mechanics problems associated with friction forces
5) Obtain the centroid, first moment and second moment of an area
6) Describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference
7) Analyze the forces causing the motion of a particle
8) Use the equation of motion to describe the accelerated motion of a particle
9) Apply work, energy, impulse and momentum relationships for a particle in motion
10) Describe the motion of a rigid body in different frames of reference

IV. Professionalism:

1) Maintain high productivity and high ethical standards.
2) Continually enhance their knowledge throughout their careers.
Communicate effectively to a broad range of audiences.

4) Function on and lead teams that engage in new areas of research and development in engineering, particularly those that cross the boundaries of traditional disciplines.

5) To produce graduates who can be successful in graduate level work in engineering, as well as in other professional schools.

6) Become closer to being an engineer.

7) To produce graduates with the oral and written communication skills needed to successfully work in a modern multidisciplinary environment.

V. Learning Environment:

1) To produce graduates with the ability to both seek out assistance when needed and to learn new skills throughout their careers

2) To produce graduates with the oral and written communication skills needed to successfully work in a modern multidisciplinary environment.

3) Develop capacity for logical, orderly, step-by-step methods of analysis and clear communication of results.

Outcomes:

The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.

1) An ability to apply fundamental knowledge of mathematics, science, and engineering

2) An ability to design and conduct mechanics experiments

3) An ability to analyze and interpret experimental and computational mechanics data

4) An ability to design a system, component, or process to meet desired needs by synergistically combining mechanics of materials, fluid mechanics, and dynamics, when necessary

5) An ability to effectively function as the leader, or member, of a multi-disciplinary team

6) An ability to identify, formulate, and solve engineering problems involving mechanics of materials, fluid mechanics, and/or dynamics

7) An understanding of professional and ethical responsibility

8) An ability to communicate effectively – orally, graphically, and in writing

9) The broad education necessary to understand the impact of engineering solutions on society and the environment

10) A recognition of the need for, and an ability to engage in, life-long learning and accomplishment

11) Knowledge of contemporary issues (e.g., social, political, technical, economic, etc.)

12) A fundamental understanding that will enable the appropriate use and development of the techniques, skills, and modern engineering tools necessary for engineering practice

13) Recognition of the importance of safety in phases of engineering design and practice.

14) Recognition of the need for and the ability to engage in life-long learning.

15) An understanding of the role of the leader and leadership principles.
1) Preparation: To understand working principles and applications of electronic devices and circuits.
2) Core competence: To design, analyze, build and test the electronic circuit.
3) Breadth: The integration of electronic engineering, electrical engineering, computer technology and control engineering forms a crucial part in the design, manufacture and maintenance of a wide range of engineering products and processes. To implement the ideas with well acquaintance of fundamental electronic principles. To correlate the requirements of industries and his knowledge to serve the industry for its best performance.
4) Professionalism: -Learning environment: To provide student with an excellent academic environment, leadership, learning skills for long-life successful professional

102012: Engineering Graphics II:

Objectives:
Students should be able to understand:
1. Various drafting software
2. To read, prepare, analyze the drawing data i.e. lines, planes, projection of points, solids, Section of solids, Development of surfaces.
In order to achieve PEOs following steps should be taken:
1. Practices are conducted.
2. Assignments are given.
3. Students will be able to read drawing & draw object.
4. Students will be able to use various drawing software.
5. Drawing sheets are given.

102013: Basic Mechanical Engineering:

Objectives:
Students should be able to understand:
1. Basic mechanical systems
2. Design, construction & working of machine elements, mechanism.
3. Introduction to thermal fluid science
4. Manufacturing process, m/c tools.
5. Energy conversion, absorption & energy producing devices.

In order to achieve PEOs following steps should be taken:
1. Demonstration is to be delivered
2. Tests are conducted
3. Practices are conducted
4. Assignments are to be given
5. Oral is to be conducted as a part of term work. Students should be able to understand:

Communication skill:
Objectives:
1. Fundamentals of communication skill.
2. Learning skill.
3. Speaking skill.
4. Writing skill.
5. Organization & Listening comprehension in communication.
6. Reports, Resumes & Job application.

In order to achieve PEO's following steps should be taken:
1. Group discussion is arranged
2. Assignments are to be given
3. Tests are conducted
207001 : Engineering Mathematics III:

Objectives:
Students should be able to understand:
1. Ways to apply mathematical methods to solve Engineering problems.
2. Complex analysis, Statistics & probability.
3. Vector calculus.
5. Modern approaches to the area, ordinary differential equations, linear algebra.

In order to achieve PEOs following steps should be taken
1. Assignments are to be given. 2. Tests are conducted.

201001 : Building Materials and Construction:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of understanding and construction of Structures.
2) To produce civil engineering graduates who are introduced with all basic activity of construction from foundation to finishing.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn the all basic activity of construction.
2) To learn the different types of foundation.
3) To study all component of building like masonry, doors, window, flooring, finishing materials.
4) To study vertical circulation in building.
5) To study various miscellaneous material.

III. Breadth
1) To train the students of civil engineering with all basic terms of construction activity so that they can do planning, design and execute the all construction activity.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of these public schemes.
2) To train the students to develop their carrier in execution of construction.
V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to perform all construction activity from foundation to final stage.
2) Engineers having the ability to improve the existing systems.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

201002 : Strength of Materials :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of understanding and designing of Structures.
2) To produce civil engineering graduates who are introduced with Analysis of Structures.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different types of structures and different types of loading.
2) To learn behavior of different types of structures under different type of loading
3) To study and to analyze different types of structures.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyse and design different types of structures
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of these public schemes.
2) To train the students to develop their carrier in Design of Structures.
V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the
time of graduation. The outcomes essentially indicate what a student can do from subject-
wise knowledge acquired during the programme.
1) Engineers with the ability to analyze and design different types of structures.
2) Engineers having the ability to improve the existing Structures.
3) Engineers having the ability to function as the leader, or member, of a multi-
disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

201003 : Engineering Geology :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who can understand the basics of engineering
geology and Introductory part of the earth science.
2) To produce civil engineering graduates who can understand the basics of Building
materials which are like to create the difficulties.
3) To produce graduates who have the ability to differentiate between the Building
materials and the usage of them before using the sites.
4) To produce graduate civil engineers who can excel and pursue this in post graduate
programs.

II Breadth
1) To train the students of civil engineering with good scientific and engineering breadth
so that they can analyze, design and execute the engineering projects.
2) To train the students so that they can optimize the systems for safe and economical
projects.

III. Core Competence:
1) To study the sources, and characterization of common Building materials
2) To learn sources of various Building materials, their characteristics, quality and other
important aspects of them.
3) To learn the use of Building materials and to decide the feasibility of the project from
geological point of view.
4) To study the basic aspects arise due to structural features like folds and faults.
5) To study the problems and difficulties those are likely to arise due to nature of the
earth.

IV. Professionalism:
1) To develop the student’s approach to take leadership and teamwork for execution of public schemes like dams, tunnels, roads, etc.
2) To train the students to develop their career in execution of the above mentioned projects.
3) To produce civil engineering graduates, capable of understanding the problems of the society.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide geological assistance as and when needed at the sites.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme. Engineers with the ability to analyze design and execute the various public schemes like dams, tunnels, roads.

201004: Geotechnical Engineering:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of soil mechanics, geotechnical engineering.
2) To produce civil engineering graduates who are introduced with basics of index & engineering properties of soil.
3) To produce graduates who have the ability to pursue careers as practicing geotechnical engineer.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn origin & formation process of soil.
2) To learn the types of soil depending on formation process.
3) To study classification systems.
4) To study of strength properties, seepage characteristics & compressibility characteristics.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyse, design foundation works.
2) To train the students so that they can optimize the design for effectiveness and economy.

IV. Professionalism:
1) To train the students to develop their career as geotechnical consultant.
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the
time of graduation. The outcomes essentially indicate what a student can do from subject-
wise knowledge acquired during the programme.
1) Engineers with the ability to analyze design and execute the foundation
works.
2) Engineers having the ability to improve the existing foundation systems.
3) Engineers having the ability to function as the leader, or member, of a multi-
disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

201005 : Fluid Mechanics I :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Fluid
Mechanics.
2) To produce civil engineering graduates who are introduced with Fluid StaticÂ’, Fluid
kinematics & Fluid dynamics.
3) To produce graduates who have the ability to pursue careers as practicing and
Hydraulic Engineering.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different types of fluid flow.
2) To learn Dimensional Analysis.
3) To study and to analyze Characteristics of Turbulent flow & Flow through Pipes.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth
so that they can be able to design the pressure measuring devices.
2) To train the students so that they can optimize the systems for effectiveness and
economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of
Hydraulic Engineering.

2) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out the Calibration of Venturimeter, Orifice meter & Notch.
2) Engineers having the ability to improve the existing pressure measuring devices
3) More and more students going for post graduation in this field.

201006: Building planning:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of planning of various types of structures.
2) To produce civil engineering graduates who are introduced with principles of planning and principles of architectures.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn effective planning of various types of buildings.
2) To learn how to use natural resources in the planning of buildings.
3) To study various factors related to building planning.
4) To learn different

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can do planning, designing of various types of building.
2) To train the students so that they can utilize this knowledge in career development.
3) To groom the students in

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of
V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the
time of graduation. The outcomes essentially indicate what a student can do from subject-
wise knowledge acquired during the programme.
1) Engineers with the ability to analyze and design different types of structures.
2) Engineers having the ability to improve the existing Structures.
3) Engineers having the ability to function as the leader, or member, of a multi-
disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

201007 : Surveying I :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Plane Surveying.
2) To produce civil engineering graduates who are introduced with Horizontal and vertical measurements.
3) To produce graduates who have the ability to pursue careers as practicing and consulting civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different types of Instruments used for plane surveying.
2) To learn different methods of surveying.
3) To study and to analyze different types advancements in plane surveying such as
electronic instruments and softwares.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth
so that they can carry out field surveys for civil engineering works.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of civil engineering jobs.
2) To train the students to develop their carrier in civil engineering consultations.
3) To produce civil engineering graduates, capable of involve in social works.

1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out field surveys and prepare different types of project proposals.
2) Engineers having the ability to improve the existing civil engineering projects.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

201008 : Concrete Technology :

Objectives:

I. Preparation:
1) To prepare the students to understand various types of cements and their chemical and physical properties and their suitability for a particular type of work.
2) To prepare the students to understand properties of sand, coarse aggregate and water for producing good quality concrete.

II Breadth
1) To train the students of civil engineering with good scientific and engineering breadth about the use of mineral additives like fly ash in concrete for the preservation of natural resources.
2) To train the students of civil engineering with good scientific and engineering breadth about the use of chemical additives in concrete for the improvement of properties of concrete in wet and hardened state.

III. Core Competence:
To train the students to design concrete mix of various grades for compressive strength and desired durability.

IV. Professionalism:
1) To develop the students to check the qualities of various ingredients of concrete, properties of concrete in wet and dry condition.

V. Learning Environment:
To prepare the students to learn how to decide the quality of ingredients of concrete on visual inspection.
Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to decide which type of cement, mineral additive and which chemical admixture to be used to improve the overall quality of concrete.
2) Engineers having the ability to check the produced concrete for homogeneity and consistency.
3) Engineers having the ability to design concrete mix for a particular placing condition.

201009 : Structural Analysis I :

Objectives:

I. Preparation:
1) To prepare the students to understand the basics of configuration and classification of structures.
2) To prepare the students to understand the basics of structural analysis.

II Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyze the structures.
2) To train the students so that they can optimize structural systems for effectiveness and economy through proper configuration of structure.

III. Core Competence:
1) To perceive the proper structural system to withstand the loads likely to be imposed on it.
2) To train the students to analyze the structures using various softwares.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork in the structural design and execution of various structures.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.

1) Engineers with the ability to analyze the Structures manually and using soft computing tools.
2) Engineers having the ability to improve the existing systems.
3) Engineers having the ability to function as the leader, or member, of multi-disciplinary team.
4) More students working as entrepreneur in the field of analysis and design of structures.

T. E. Civil Engineering (2008 Course):
301001: Structural Analysis II:

Objectives:

I. Preparation:
1) To prepare the students to understand the basics of configuration and classification of structures.
2) To prepare the students to understand the basics of structural analysis.

II Breadth
III. Core Competence:
1) To perceive the proper structural system to withstand the loads likely to be imposed on it.
2) To train the students to analyze the structures using various softwares.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork in the structural design and execution of various structures.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to analyze the Structures manually and using soft computing tools.
2) Engineers having the ability to improve the existing systems.
3) Engineers having the ability to function as the leader, or member, of multi-disciplinary team.
4) More students working as entrepreneur in the field of analysis and design of structures.

301002: Infrastructure Engineering & Construction Techniques:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of construction techniques.
2) To produce civil engineering graduates who are introduced with various equipments used in construction works.
3) To produce civil engineering graduates who are introduced with the basics of understanding of railways, Tunnel, Docks and Harbors.
4) To produce civil engineering graduates who are introduced with Railway and waterways as a means of communication.
5) To produce graduates who have the ability to pursue careers as practicing civil engineers in the field of railway engineering and offshore components require for waterways.
6) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn Mechanization in Construction industry, different types of Instruments used in construction industry.
2) To learn different Miscellaneous Techniques in construction works.
3) To learn different types modes of transportation and their basic elements.
4) To learn the need of railways, tunnels, and waterways.
5) To study and to analyze different types advancements in construction Equipments, Economic, maintenance and repair of the construction Equipments.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can carry out the various constructions field works with different construction equipments.
2) To train the students so that they can optimize the use of construction equipments for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of civil engineering jobs.
2) To train the students to develop their carrier in civil engineering consultations.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out field works and prepare different types of project proposals.
2) Engineers having the ability to improve the existing civil engineering projects.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

301003: Structural Design I:

Objectives:

I. Preparation:
1) To provide a basic understanding of the mechanical properties and types of steels used in civil structures, and to develop technical competence in the design of tension and compression members, beams, and simple bolted and welded connections.

2) To produce graduates who have the ability to pursue careers as practicing civil engineers.

II. Core Competence:
1) Determine the ultimate tensile capacity of steel members considering both yielding and tensile fracture.
2) Determine the ultimate bending moment capacity of steel members considering both yielding and lateral buckling
3) Assess shear capacity of beams and design web bearing stiffeners if required
4) Determine the effective length of compression members in both braced and sway conditions
5) Describe different welding techniques and classify different types of bolts and their installation
6) Design bolted connections in shear, tension and combined actions
7) Design welded connections and fastener groups

III. Breadth:
1) Discuss properties of steel and concrete used in design of steel structures.
2) Introduce students to main load effects such as gravity, wind, seismic, snow and hydrostatic pressure and provide values of these loads as prescribed by the Indian Standard.
3) Discuss actual behavior of members and connections in steel structures when subjected to axial and shear forces, bending moment and combination of these load effects. In support of this objective, conduct actual tests of steel members subjected to tension, compression, bending and combination of these effects in the structural laboratory.

IV. Professionalism:
2) Continually enhance their knowledge throughout their careers.
3) Communicate effectively to a broad range of audiences.
4) Function on and lead teams that engage in new areas of research and development in engineering, particularly those that cross the boundaries of traditional disciplines.
5) To produce graduates who can be successful in graduate level work in engineering, as well as in other professional schools.
6) Become closer to being an engineer.
7) To produce graduates with the oral and written communication skills.

V. Learning Environment:
1) To produce graduates with the ability to both seek out assistance when needed and to learn new skills throughout their careers.
Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) An ability to apply fundamental knowledge of mathematics, science, and engineering
2) An ability to design and conduct mechanics experiments
3) An ability to analyze and interpret experimental and computational mechanics data
4) An ability to design a system, component, or process to meet desired needs by synergistically combining mechanics of materials, fluid mechanics, and dynamics, when necessary
5) An ability to effectively function as the leader, or member, of a multi-disciplinary team
6) An ability to identify, formulate, and solve engineering problems involving mechanics of materials, fluid mechanics, and/or dynamics
7) An understanding of professional and ethical responsibility
8) An ability to communicate effectively orally, graphically, and in writing
9) The broad education necessary to understand the impact of engineering solutions on society and the environment
10) A recognition of the need for, and an ability to engage in, life-long learning and accomplishment
11) Knowledge of contemporary issues (e.g., social, political, technical, economic, etc.
12) A fundamental understanding that will enable the appropriate use and development of the techniques, skills, and modern engineering tools necessary for engineering practice
13) Recognition of the importance of safety in phases of engineering design and practice.
14) Recognition of the need for and the ability to engage in life-long learning.
15) An understanding of the role of the leader and leadership principles.
16) Ability to function effectively as an individual and in multi-disciplinary and multi-cultural teams, with the capacity to be a leader or manager as well as an effective team member
17) Understanding of professional and ethical responsibilities and commitment to them
18) Expectation of the need to undertake lifelong learning, and capacity to do so

301004 : Fluid Mechanics II :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Hydraulic machineries & Open Channel flow.
2) To produce civil engineering graduates who are introduced with Flow around submerged bodies & unsteady flow.
3) To produce graduates who have the ability to pursue careers as Hydraulic Engineer.
1) To learn different types of Hydraulic Turbines.
2) To learn Performance of Centrifugal Pump.
3) To study and to analyze Characteristics of GVF profiles & computer program on GVF.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can be able to design the Hydraulic of Machineries.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of Hydropower Engineering.
2) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out different types of Hydraulic Projects.
2) Engineers having the ability to improve the existing Hydropower Plants.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

301005 : Advanced Surveying :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Geodetic Surveying.
2) To produce civil engineering graduates who are introduced with Horizontal and vertical controls.
3) To produce graduates who have the ability to pursue careers as practicing and consulting civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different types of Instruments used for Geodetic surveying.
III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can carry out field surveys for civil engineering works.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of civil engineering jobs.
2) To train the students to develop their carrier in civil engineering consultations.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out field Geodetic surveys and prepare different types of project proposals.
2) Engineers having the ability to improve the existing civil engineering projects.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

301006 : Hydrology and Water Resources Engineering:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of hydrology and Irrigation engineering.
2) To produce civil engineering graduates who are introduced with meteorological measurements and abstracts of precipitation.
3) To produce graduates who have the ability to pursue careers as practicing and consulting civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different types of Instruments used in hydrology and meteorology.
2) To learn different methods of hydrologic and Irrigational analysis.
III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can carry out field hydrologic surveys for civil engineering works.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of civil engineering jobs.
2) To train the students to develop their carrier in water resources and irrigation engineering consultations.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out field hydrologic surveys and prepare different types of project proposals.
2) Engineers having the ability to improve the existing civil engineering projects.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

301007 : Project Management & Engineering Economics:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Project Management.
2) To produce civil engineering graduates who are introduced with various techniques such as CPM, PERT, updating, crashing, resource leveling.
3) To produce graduates who have the ability to pursue careers as project managers as decision making skills & analysis.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn Contract Administration & Material Management.
2) To learn different Numerical methods as Newton Rahson Method, Lagrangian
III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can use the different softwares on project management.
2) To train the students so that they can optimize the use of Project management for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of civil engineering jobs.
2) To train the students to develop their carrier in civil engineering consultations.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out Computer program- software for programming in Fluid mechanics ,Soil mechanics, Project Mgt.
2) Engineers having the ability to improve the existing civil engineering projects.
3) Engineers having the ability to function as the leader, or member, of a multi-Disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

301008 : Structural Design II :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with Analysis of Structures.
2) To produce civil engineering graduates who are introduced with the basics of understanding and designing of R.C.C. Structures.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different elements of the structure and their behavior under load.
III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyse and design different types of structures.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of these public schemes.
2) To train the students to develop their carrier in Design of Structures.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to analyze and design different types of structures.
2) Engineers having the ability to strengthen the existing Structures.
3) Engineers with the ability to read the structural drawings and accordingly to execute the construction work.
4) Engineers having the ability to function as the leader, or member of a multi-disciplinary team.
5) More and more students going for post graduation in this field.
6) More students working as entrepreneur in this stream.

301009 : Environmental Engineering I :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of water supply and treatment
2) To produce civil engineering graduates who are introduced with basics of Air pollution, noise pollution and solid waste management.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.
II. Core Competence:
1) To learn sources of water, water demand, conveyance of raw water, quality and characteristics and other machineries of water supply.
2) To learn the water treatment process, other treatment alternatives
3) To study the water distribution system.
4) To study of air pollution sources, air pollution control and health and other factors associated with air pollution.
5) Study of noise pollution measurement and control.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyse, design and execute the water supply works.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of these public schemes.
2) To train the students to develop their carrier in execution of waterworks.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to analyze design and execute the water works.
2) Engineers having the ability to improve the existing systems.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

301010 : Foundation Engineering :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Foundation engg.
2) To produce civil engineering graduates who are introduced with concept of shear strength & settlement criteria.
3) To produce graduates who have the ability to pursue careers as practicing Geotechnical engineer.
4) To produce graduate civil engineers who can excel in post graduate programs.
II. Core Competence:
1) To learn types of foundation of buildings.
2) To learn bearing capacity theories.
3) To study settlement analysis.
4) To study of improvement techniques.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyse, design foundation works.
2) To train the students so that they can optimize the design for effectiveness and economy.

IV. Professionalism:
1) To train the students to develop their carrier as geotechnical consultant.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to analyze design and execute the foundation works.
2) Engineers having the ability to improve the existing foundation systems.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.
401001 : Environmental Engineering II :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who can understand the basics of waste water engineering and waste management systems.
2) To produce civil engineering graduates who can understand the basics of Air solid and hazardous waste management.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyze, design and execute the sewerage and waste water treatment works.
2) To train the students so that they can optimize the systems for effectiveness and economy.

III. Core Competence:
1) To study the sources, and characterization of wastewater, pollutational problems.
2) To learn sources of wastewater, water demand, conveyance of raw water, quality and characteristics and other machineries of water supply.
3) To learn the wastewater treatment process, other treatment alternatives
4) To study the wastewater collection system.
5) To study the hazardous waste treatment, disposal and management

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of these pubic schemes and waste management.
2) To train the students to develop their carrier in execution of sewerage and wastewater works.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to analyze design and execute the wastewater works.
2) Engineers having the ability to improve the existing systems.
3) Engineers having the ability to function as the leader, or member, of a multi-
disciplinary team.

4) More and more students going for post graduation in this field.

401002 : Dams & Hydraulic Structures :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of
   Gravity dams & Earth dams.
2) To produce civil engineering graduates who are introduced with Spillways &
   Diversion Head works.
3) To produce graduates who have the ability to pursue careers in Dam Design &
   Construction.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different types of Hydro Power Plants.
2) To learn Canal Masonry Works & Canal Irrigation.
3) To study and to analyze Design of Spillway and stilling basin.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth
   so that they can be able to design cross drainage works
2) To train the students to evaluate the Benefit cost analysis of a water resources project.
3) To train the students so that they can optimize the systems for effectiveness and
   economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of
   Hydropower Engineering.
2) To develop the students approach to prepare report based irrigation projects
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the
time of graduation. The outcomes essentially indicate what a student can do from subject-
wise knowledge acquired during the programme.

1) Engineers with the ability to prepare different types of Hydraulic Projects.
2) Engineers having the ability to improve the existing dam structures.
3) Engineers having the ability to function as the leader, or member, of a multi-
disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.
Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with Analysis of Structures.
2) To produce civil engineering graduates who are introduced with the basics of understanding and designing of R.C.C. and P.S.C. Structures.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different elements of some special structures like retaining walls, liquid retaining structures, combined footings and their behavior under load.
2) To learn load calculations and load transfer phenomenon of the structure.
3) To analyze the structure for different load combinations.
4) To learn section design and detailing.
5) To learn concept and application of Prestressing in structures.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can analyse and design different types of structures
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of these public schemes.
2) To train the students to develop their carrier in Design of Structures.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to analyze and design different types of structures.
2) Engineers having the ability to strengthen the existing Structures.
3) Engineers with the ability to read the structural drawings and accordingly to execute the construction work.
4) Engineers having the ability to function as the leader, or member of a multi-disciplinary team.
401004: Architecture and Town Planning:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of architecture and planning of community.
2) To produce civil engineering graduates who are introduced with principles of planning and principles of architectures.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers and town planners.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn effective planning of various types of buildings.
2) To learn how to use natural resources in the planning of buildings.
3) To study various zones factors related to building planning.
4) To learn different methods of construction using ecofriendly materials.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can do planning, designing of various types of building.
2) To train the students so that they can utilize this knowledge in career development.
3) To groom the students in this area.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of these public schemes.
2) To train the students to develop their carrier in designing and planning.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to analyze and design different types of structures.
2) Engineers having the ability to improve the existing Structures with advanced systems of planning and designing.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Construction Management.
2) To produce civil engineering graduates who are introduced with Project Appraisal, Development & Financial Management.
3) To produce graduates who have the ability to pursue careers as practicing and Construction Manager.
4) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn the role of CIDC in construction sector.
2) To learn different sources in Resource Management.
3) To study and to analyze different types of advancements in Disaster Management & Risk Management.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can prepare a safety programme for construction work.
2) To train the students so that they can optimize the Construction Management systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to take leadership and teamwork for execution of civil engineering jobs as a Construction Manager.
2) To train the students to develop their carrier in civil engineering consultations.
3) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to prepare Risk Assessment tables & the report on Construction work.
2) Engineers having the ability to improve the existing civil engineering projects.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.
401007 : System Approach Engineering :

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of Identification of Civil engineering systems and their methods analysis.
2) To produce civil engineering graduates who are introduced with System Concepts, System Parameters and Objectives.
3) To produce graduate civil engineers who can excel in post graduate programs.

II. Core Competence:
1) To learn different types of Optimization Techniques.
2) To learn Linear & Nonlinear Programming.
3) To study and to analyze Dynamic Programming.

III. Breadth
1) To train the students of civil engineering with good scientific and engineering breadth so that they can be able to find the benefit / Cost analysis of the system.
2) To train the students so that they can optimize the systems for effectiveness and economy.

IV. Professionalism:
1) To develop the students approach to Construction Optimization.
2) To produce civil engineering graduates, capable of involve in social works.

V. Learning Environment:
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to carry out computer based programming on linear & linear programming.
2) Engineers having the ability to improve the Transportation Models.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.

401009 : Quantity surveying, Contracts and Tenders:
Objectives:

I. Preparation:
1) To prepare the students to understand the structure in its three dimensions.
2) To prepare the students to understand item of work and methods of calculating the quantities of various items of work.

II. Breadth:
1) To train the students of civil engineering with good scientific and engineering breadth so that they can work out the quantities, materials and labourers required for various items of work.

III. Core Competence:
1) To prepare the students to differentiate between estimating of a structure and valuation of structure.
2) To prepare the students to analyze the rate of various materials and labourers based on current market rates of materials and wages of labourers.

IV. Professionalism:
1) To develop the students to understand tendering and contract documents.
2) To train the students competent enough in filling the tender for different works.
3) To produce civil engineering graduates, capable of checking the rates quoted by the contractors and make the comparative statement.

V. Learning Environment:
To prepare the students to understand local and global tendering, BOT type, BOO type tendering etc.

Outcomes:
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability to perform all operations leading to quantity evaluation.
2) Engineers having the ability to fill tender and check tender documents.
3) Engineers having the ability to decide the genuine contractor for particular type of work.
4) More and more students going for post graduation in this field.

401010 : Transportation Engineering II:

Objectives:

I. Preparation:
1) To produce civil engineering graduates who are introduced with the basics of understanding and designing of Highways, Bridges, and Airports.
2) To produce civil engineering graduates who are introduced with Transportation Systems and Design.
3) To produce graduates who have the ability to pursue careers as practicing civil engineers in the field of Transportation Engineering.
To produce graduate civil engineers who can excel in post graduate programs in transportation and infrastructure developments.

**II. Core Competence:**
1) To learn different modes of transportation and a Geometric and structural design of flexible and rigid pavements.
2) To learn basics in highway planning, surveys, traffic studies, geometric design of roads. Basic elements of Airport Engineering. Types, classification, loading for design of bridges
3) To study and design of pavements. Materials characterization, construction, and Quality control.

**III. Breadth**
1) To train the students of civil engineering with good scientific and engineering breadth so that they can design and construct different types pavements, bridges and Airports.
2) To train the students so that they can optimize the systems for effectiveness and economy.

**IV. Professionalism:**
1) To develop the students approach to take leadership and teamwork for execution of these public schemes.
2) To train the students to develop their carrier in the field of Transportation Engineering and infrastructure development.
3) To produce civil engineering graduates, capable of involve in social works.

**V. Learning Environment:**
1) To produce graduates with the ability to learn new skills throughout their careers.
2) To produce the students who will provide assistance as needed.

**Outcomes:**
The programme outcomes are the skills and knowledge which the students have at the time of graduation. The outcomes essentially indicate what a student can do from subject-wise knowledge acquired during the programme.
1) Engineers with the ability of planning design and construction of different types of roads, Bridges and Airports.
2) Engineers having the ability to improve the existing pavements, Bridges and Airports.
3) Engineers having the ability to function as the leader, or member, of a multi-disciplinary team.
4) More and more students going for post graduation in this field.
5) More students working as entrepreneur in this stream.