The following colour represents the syllabus revision, skill, employability and entrepreneurship.

Green : Skill

Pink : Employability

Sky : Entrepreneurship

Syllabus

Geotechnical Engineering

Code	Course Title	Credit	T-P-PJ
CUTM1073	Geotechnical Engineering	3	1-1-1

Objective

- Perform Moisture content, Specific gravity, Atterberg limits tests.
- Perform Grain size distribution, Proctor tests.
- Perform Unconfined compression, Triaxial tests.
- Perform California Bearing Ratio, Vane Shear tests.
- Perform Sand replacement, Core cutter, Permeability tests.

Learning outcome

- To obtain knowledge about soil properties and methods of soil properties determination in the laboratory, using field tests and considering comparable experience. Basic stability and deformation problems. Principle of spread and deep foundation design. To understand fundamental knowledge of geotechnical works for soil improvement, interaction of structure and subsoil. Basic design methods for excavation and foundation pits with dewatering and sealing systems.
- Design and analyse Shallow foundations manually as well as using STAAD Pro
- Design and analyse Deep foundations manually as well as using STAAD Pro

- Carry out Moisture content, Specific gravity, Atterberg limits tests.
- Carry out Grain size distribution, Proctor tests.
- Carry out Unconfined compression, Triaxial tests.
- Carry out California Bearing Ratio, Vane Shear tests
- Carry out Sand replacement, Core cutter, Permeability tests.

Course content

Module I:(5hrs)
Theory :(2hrs)

(a) INTRODUCTION: Soil formation - soil structure and clay mineralogy - Adsorbed water - Mass- volume relationship - Relative density.

(b) INDEX PROPERTIES OF SOILS: Grain size analysis - Sieve and Hydrometer methods - Consistency Limits and Indices - I.S. Classification of soils

(c) PERMEABILITY: Soil water - capillary rise - flow of water through soils - Darcy's law- permeability - Factors affecting - Determination of coefficient of permeability - Permeability of layered systems

(d) SEEPAGE THROUGH SOILS: Total, neutral and effective stresses - quick sand condition - Seepage through soils - Flow nets: Characteristics and Uses (Basic appraisal only) .

Practice:(3hrs)

1. Determination of water content of soil (1hrs)
2. Determination of specific gravity of soil(1hrs)
3. Grain size analysis by sieving (Dry sieve analysis) (1hrs)

Module II: (5hrs)

Theory :(1.5hrs)

(e) BCOMPACTION: Mechanism of compaction - factors affecting - effects of compaction on soil properties. Field compaction Equipment - compaction control.

(f) CONSOLIDATION: Stress history of clay; e-p and e-log p curves - magnitude and rate of 1-D consolidation- Terzaghi's Theory.

Practice:(3:30hrs)

4. Determination of field density by sand replacement method.(1hrs)
5. Determination of consolidation properties of

soils**.(1:15mins)**

6. Determination of unconfined compressive strength of soil**(1:15mins)**

Module III: (6hrs)

Theory :(1.5hrs)

(g) SHEAR STRENGTH OF SOILS: Mohr - Coulomb Failure theories

(h) STRESS DISTRIBUTION IN SOILS: Normal and shear stresses on a plane, Boussinesq's solution.

Practice:(1hrs)

7. Determination of shrinkage limit; Determination of permeability by constant head method (1hrs)

Project :(3:30 hrs)

Types of shear strength test to be delivered as project mode, rest of the topics to be dealt in classroom teaching mode, Mathematical Derivations to be limited to classroom activity. They should not be a part of External Evaluation.

Module IV: (7hrs):

Theory:(1hrs)

(i)DESIGN OF SHALLOW FOUNDATIONS: Introduction, Different types of shallow foundations, (j)DESIGN OF DEEP FOUNDATIONS: Introduction, Different types of deep foundations, Design methodology for piles.

Practice: (1hrs)

8. California bearing ratio test (1hrs)

Project :(5hrs)
Design calculation of shallow foundation to be done in project mode using STAAD Pro software.

design calculation of pile capacity, Analysis of pile group, Settlement of pile group, Concept of negative skin friction, Piles subjected to lateral loads, Pile load test, Design and construction of well foundation. Design of cantilever sheet piles and anchor sheet piles to be done in practice mode as well as project mode using STAAD Pro software.

Module V: (4:30 hrs):
Theory:(2hrs)

(k) FOUNDATIONS IN DIFFICULT GROUNDS: Introduction, Techniques of ground improvement, Foundations in swelling soil, Foundations in collapsible soil, Use of soil

reinforcement.

(l) MACHINE FOUNDATIONS: Introduction, Free and forced vibration, Lysmer's method, dynamically loaded foundations, Dynamic soil properties, Vibration isolation **. BASIC APPRAISAL ONLY.NO NUMERICAL PROBLEMS)**

Practice:(2:30hrs)

9. Determination of shear parameters by Direct shear test(1:30hrs)

10. Determination of compaction properties by standard proctor test. (1hrs)

Module VI: (5 hrs)

Practice: (1 hrs)

11. Determination of shear parameters by Tri-axial test. **(1hrs)**

Project :(4 hrs)

STABILITY OF SLOPES: soil stabilization measures. Slope stability solutions to done using software Stability analysis of rigid walls, (MATLAB)

Module VII:(2hrs)

(0) EARTH PRESSURE: Types of Earth pressure. Rankine's Active and passive earth pressure, Smooth Vertical wall with horizontal backfill. Extension to Soil, Coulombs wedge theory**.**

(p) DESIGN OF RETAINING STRUCTURES: Introduction, Different types of retaining structures

E Books: Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.

Ranjan Gopal and Rao A S R. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.

Singh Alam. 1994. Soil Engineering Vol. I. CBS Publishers and Distributions, Delhi.

Construction Material Testing

Code	Course Title	Credit	T-P-PJ
CUTM1069	Construction Material Testing	2	0-2-0

Objective

- Understand the range of various materials for Civil Engineering projects.
- Understand relevant properties of common construction materials.
- Perform measuring, testing and evaluating the results.

Learning outcome

- Test, measure, and evaluate the best use of building and construction materials.
- Gain knowledge about how to determine the standard quality of construction materials.

Course Content

MODULE I : PROPERTIES OF CEMENT (3 Hrs)

Chemical composition test (01 Hr)
Fineness test of cement (comparison study (01 Hr)
Soundness test of cement (comparison study) (01 Hr)

MODULE II: PROPERTIES OF STEEL (3 Hrs)

1. Ultimate Tensile strength test (01 Hr)
2. % of Elongation test (01 Hr)
3. Bend & rebend test (01 Hr)

Module III: PROPERTIES OF CEMENT CONCRETE (5 Hrs)

1. Gradation of Coarse Aggregates (01 Hr)
2. Flakiness Indes & Elongation Index (01 Hr)
3. Silt Content (01 Hr)
4. Preparation of cube mould for durability test (02 Hr)

Module IV : PROPERTIES OF BRICKS (2 Hrs)

1. Compression test on Bricks. (01 Hr)
2. Absorption test of brick. (01 Hr)

Module V : PROPERTIES OF TILES AND MARBLES (3 Hrs)

3. Test on tiles breaking strength. (01 Hr)
4. Water absorption test for marbles. (01 Hr)
5. Hardness test for marbles. (01 Hr)

Module VI : PROPERTIES OF TIMBER MATERIALS(5 Hrs)

1. Test on moisture content on timber. (02 Hr)
2. Air permeability, water tightness and wind resistance test for window and doors. (03 Hr)

Module VII : PROPERTIES OF BUILDING STRUCTURE(5 Hrs)

1. Slip Resistance Checking. (01 Hr)
2. Weather resistance and durability test. (02 Hr)
3. Test on durability of recycled concrete aggregates. (02 Hr)

Text Books

1. B.N Dutta 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2010.
2. M.S Shety, S. CHAND Publication, 2006.
3. Building and Construction Materials: Testing and Quality Control (Lab Manual Series) Paperback – 1 July 2017by M.L. Gambhir (Author), Neha Jamwal (Author).
4. Building Construction and Materials (SI Units) Paperback – 1 January 2017 by Gurcharan Singh (Author)

References

1. Indian standards for tests on concrete materials and mix design.
2. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003

Structural Detailing and Drawing

Code	Course Title	Credit	T-P-PJ
CUTM1061	Structural Detailing and Drawing	2	0+2+0

Objective

- To introduce the students to basic theory and concepts of Structural Drawing, STAAD Pro and the classical methods for the analysis of building drawings.
- On completion of this course the students will be able to know the process of making sketches, types of projections, designing of beam, columns and shear walls.

Learning outcome

- Perform free hand sketching of basic geometrical constructions and multiple views of objects. Concept of projection, Types of section, PEB structure & Steel structure work.
- Demonstrate STAAD- PRO, & its uses. Do frame structure, steel structure & applying properties, loads, shear force and bending moment. Do design of steel, /concrete structure & bridge design.

Course Content

MODULE 1 – INTRODUCTION OF ENGINEERING DRAWING (02 hrs)

Setting of paper size, drawing of title block with border line - Drawing of Types of line, their properties, and arrow head - Types of scale, dimensioning rules & their uses.

MODULE 2 – ORTHOGRAPHIC AND ISOMETRIC PROJECTION (04 hrs)

Concept of projection - Types of projection and applying symbol of projection - Isometric scale - Isometric view.

MODULE 3 – SECTIONING (04 hrs)

Types of section – Application - View positioning - steel structure - PEB structure & Steel structure work - Syphon , culvert & bridge design - Stair ,door & ventilator design and calculation.

MODULE 4 – INTRODUCTION OF STAAD Pro (02 hrs)

Introduction to structural design & analysis, brief introduction about RCC structure - Doing frame structure - Calculating coordinate points, properties of building.

MODULE 5 – PLANE & SPACE FRAME STRUCTURE (03 hrs)

Load, types & uses of load, calculation of dead load, live load & floor load - Working with design and analysis of building &, steel structure, preparation of RCC report - Applying load (wind load, seismic load, floor load, live load, dead load) using by water tank, tower, truss & multi stored building.

MODULE 6 – DESIGN OF BEAM AND COLUMN (02 hrs)

Design of beam and column, file transfer, concrete design, steel design, slab design, shear force /bending moment, solve some error - Using I.S code to define concrete design, steel & transfer to file from AutoCAD to STAAD PRO through DXF file.

MODULE 7 – SHEAR WALL DESIGN (03 hrs)

Describe about Shear wall design, & foundation - Using surface panel models to design shear wall (RC walls) & lift rooms, using STAAD -foundation to design, pile, mat, and isolated, combined footings - bridge deck design & stair case design - Response spectrum & foundation design foundation design.

Text Books:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008

References:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and layout of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Quantity Estimation & Costing

Code	Course Title	Credit	T-P-PJ
CUTM1063	Quantity Estimation & Costing	3	2+1+0

Objective

- To make familiar with calculation of quantities for different item of works & provide knowledge about estimation of buildings through Estimator-2.0 software
- On completion of this course the students will be able to know the process of making animation of buildings, Sketch up of building plans and building models.

Learning outcome

- Estimating, brick calculations & cost for different materials, foundation & footing calculations.
- Gain knowledge about how to schedule & estimate different construction works both manually and using software.

Course Content

Module - I: BUILDING (2 Hrs)

Reading of Plans, Sections and detailed Drawings Related to buildings; preparation of Quantities and Units. Introduction of estimating & different types of estimate - Requirements for building estimate purpose of estimate - Plinth area estimate, cube rate estimate, annual estimate & maintenance estimate - Brick calculation & cost for different material - No. of brick required for area, weight of bricks, different bricks densities.

Practice Sessions:

1. Study of construction drawings and preparation of WBS. (01 Hr)
2. Detailed estimates for a Shopping Complex using Estimator-2.0 software. (01 Hr)
3. Detailed estimates for a hostel Building using Estimator-2.0 software. (01 Hr)
4. Detailed estimates for a hospital using Estimator-2.0 software. (01 Hr)

Module -II : CULVERT (2 Hrs)

Estimations and Quantity Surveying: Reading of Plans, Sections and detailed Drawings Related to irrigation structures; preparation of Quantities and Units.

1. Detailed estimates (Manual) for a Slab culvert with right angled/ Splayed wing wall. (01 Hr)
2. Detailed estimates (Manual) for a box culvert. (01 Hr)

3. Detailed estimates (Manual) for a Hume pipe Culvert. (01 Hr)

Module –III: ROAD (2 Hrs)

Estimations and Quantity Surveying: Reading of Plans, Sections and detailed Drawings Related to Roads structures; preparation of Quantities and Units.

1. Detailed estimates (Manual) for a road. (01 Hr)

Module - IV: SLOPED ROOF (2 Hrs)

Estimations and Quantity Surveying: Reading of Plans, Sections and detailed Drawings Related to Sloping roof/Roof truss structures; preparation of Quantities and Units.

1. Detailed estimate (Manual) for a timber roof truss. (01 Hr)
2. Detailed estimate (Manual) for a roof cover of GI sheets. (01 Hr)

Module –V: QUANITY SURVEY (2 hrs)

Estimations and Quantity Surveying; Preparation of Quantity of materials per unit rate of work; Estimating labor.

Quantity of materials required for different items of works in buildings (Manual). (01 Hr)
Quantity of different types of labor required for different items of works (Manual). (01 Hr)

Module-VI: RATE ANALYSIS OF BUILDING

Specifications; Rate Analysis as per State Govt. and CPWD Standards.

1. Development of Excel Sheet for Rates, Specifications and Cost Estimates. (01 Hr)
2. Rate Analysis and Cost Estimates for a Shopping Complex using Estimator-2.0 software. (01 Hr)
3. Rate Analysis and Cost Estimates for a hostel Building and a hospital. (01 Hr)

Module-VII: RATE ANALYSIS OF CULVERT & ROAD

Specifications; Rate Analysis as per State Govt. and CPWD Standards

1. Rate Analysis and Cost Estimates for a Slab culvert with right angled wing wall using Estimator-2.0 software. (01 Hr)
2. Rate Analysis and Cost Estimates for an arch culvert. (01 Hr)
3. Rate Analysis and Cost Estimates for a road. (01 Hr)

MODULE VIII – PROJECT PREPARATION

1. Road section C & L-section. (01 Hr)
2. Report of detailed estimation with hard copy. (01 Hr)

Text Books

1. B.N Dutta 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006.
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 1998.

References

1. Arbitration and Conciliation Act, 1996
2. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
3. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003.

Geometric Modeling

Code	Course Title	Credit	T-P-PJ
CUTM1060	Geometric Modeling	3	0+3+0

Objective

- To introduce the students to basic theory and concepts of AutoCad, Revit and the classical methods for the analysis of building drawings.
- On completion of this course the students will be able to know the process of making sketches, dimensions, 3D Modeling and rendering.

Learning outcome

- Demonstrate use of CAD in Civil Construction, basic knowledge of operating software & commands, and benefit of civil developments in the construction industry. Do 2d &3d drafting /design with AUTO CAD software.
- Architectural modeling set up units & element properties, annotating, detailing, presentation tools, printing, export/import with Revit Architecture Software.

Course content

MODULE 1 - 2D SKETCHES AND DIMENSIONING

1. Study for Drafting and Modeling – Coordinate systems (absolute, relative, polar). (1 Hr)
2. Drawing of a Section for a duplex building. (1 Hr)
3. Drawing of an elevation for a duplex building with dimensions. (2 Hrs)

MODULE 2 - 3D SKETCHES AND PROJECTION OF DUPLEX

1. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning. (1 Hr)
2. Drawing front view, top view and side view of objects and projection of duplex building (2 Hrs)

MODULE 3 – BUILDING PLAN AND TRUSS

1. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.) (2 Hrs)
2. Drawing of a simple steel truss. (1 Hr)
3. Drawing sectional views of prism, pyramid, cylinder, cone, etc, (1 Hr)

MODULE 4 – INTRODUCTION OF REVIT ARCHITECTURE (02hrs)

1. Installing Autodesk Revit architecture and understanding the user interface. (1 Hr)
2. Creation of plan for a project by using level and sketching elements. (2 Hrs)

MODULE 5 - 3D MODELING WITH RIVET

1. Drawing isometric projection of simple objects. (1 Hr)
2. Creation of 3-D models of simple objects and obtaining 2-D multiview drawings from 3-D model. (2 Hrs)
3. Creation of 3d syphon, 3d canal fall, 3d water tank, 3d of trusts & 3d of foot over bridge. (2 Hrs)
4. Assembly drawing & attribute text - Annotation, block & w-block & leader. (2 Hrs)

MODULE 6 – WORKING WITH PROJECT AND WORK PLANES (04hrs)

1. Working with basic building components, site design and massing studies. (2 Hrs)
2. Setting color for wall, about sectioning libraries, basic knowledge of building. (2 Hrs)

MODULE 7 – ANNOTATION AND DETAILING AND RENDERING (04 hrs)

17. Creating text notes, grids, and levels. (1 Hr)
18. Working with label and detailing. (1 Hr)
19. Understanding the rendering workflow, using lights, and creating a lighting fixture. (1 Hr)
20. Displaying a light source in a view, controlling the position of a spotlight in a building model & adding plants and entourage. (2 Hr)

Text Books:

1. Groover M.P. and Zimmers E.W. Jr., "CAD/CAM, Computer Aided Design and Manufacturing",Prentice Hall of India Ltd, New Delhi, 1993.
2. Krishnamoorthy C.S.Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi,1993.
3. Sikka V. B., A Course in Civil Engineering Drawing, 4th Edition, S.K. Kataria and Sons, 1998.
4. George Omura, "Mastering in AUTOCAD 2002", BPB Publications, 2002.

Reference Books:

1. Shah.M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach to Built.
2. Verma.B.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 1989.
3. Marimuthu V.M., Murugesan R. and Padmini S., "Civil Engineering Drawing-I", Pratheeba Publishers, 2008.
4. A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors, John Wiley and Sons. Inc., 200.

Hydrology and Irrigation

Code	Course Title	Credit	T-P-PJ
CUTM1071	Hydrology and Irrigation	3	1-1-1

Course objective

- To study the basic principles and movement of groundwater and properties of ground water flow.
- To study the watershed characters and applications.
- To study the ground water resources mapping and surface water resources mapping.
- To study the hydrological disaster and role of earth observation technology.

Course outcome

- An ability to manipulate hydrological data and undertake widely used data analysis.
- An ability to use the techniques, skills, and modern engineering tools related to groundwater modelling.
- Project oriented skills shall be gained by students to work efficiently in survey, planning, design and construction in the irrigation sector.

Theory 2 hr

Hydrological cycle, Types of Rainfall, Precipitation - measurement - average precipitation over a basin, evaporation, transpiration, infiltration - Infiltration indices. Runoff -Overland flow, Types of aquifers.

Practice: 2hr

1. Determination of infiltration capacity using double ring infiltrometer.

Module II: Hydrograph 3hr

Direct runoff, Base flow, separation of base flow- Hydrograph, Unit hydrograph - Assumptions of Unit hydrograph, derivation of unit hydrograph from direct runoff hydrograph, Computation of direct runoff hydrograph for different storms using unit hydrograph theory. 1hr

Practice:

2. Construction of double mass curve using Python hr
3. Hydrograph analysis using Python. 1h

Module III: Flood Management and Rainwater Harvesting 4hr

Indian rivers and floods, Causes of floods, Flood damage analysis. Design flood, Flood estimation, Frequency analysis, Flood routing through reservoirs and open channels. 1hr

Necessity of Rainwater harvesting, Importance of Rain water harvesting, Rainwater harvesting methods, Conservation and Harvesting of rain. Types and design of water harvesting structures; traditional rain water harvesting structures. 1hr

Practice:

4. Mapping of Drainage order from toposheets 1hr
5. Calculation of area and length of drainage. 1hr

Module IV: Groundwater Pollution & Quality Analysis 3hr

Sources of pollution; Potential evaluation of groundwater pollution; Physical, Chemical, Biological analysis, Surface and subsurface investigations of groundwater. 1hr

Practice:

6. Physio-chemical analysis of groundwater in laboratory 2hr

Module V: Reservoir 2hr

Types, Investigations, Site selection, Zones of storage, Safe yield, Reservoir capacity, Reservoir sedimentation and control. Introduction to Dams, types of dams, spillways and ancillary works, Site assessment and selection of type of dam, Information about major dams and reservoirs of India.

Module VI: Hydropower Engineering: 2hr

Dams and their causes of failure**,** planning of water resources projects, single and multipurpose projects, Reservoir Planning: Storage capacity of reservoirs, Yield from reservoir, Mass curve, Reservoir losses, reservoir sedimentation.

Module VII: Irrigation 6hr

Irrigation Engineering: Water requirements of crops, consumptive use, quality of water for irrigation, duty and delta, irrigation methods and their efficiencies. 1hr

Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributary canals, most efficient section, lined canals, their design, regime theory - Kennedys and Laceys theories. Lined canals, Water logging - causes and control. 1hr

Practice :

7. Design of irrigation canal using Kennedy's and Lacey's theory. 1hr
8. Design of lined canal. 1hr
9. Design of tank surplus and vertical drop weir. 1hr
10. Design of head regulators and cross regulators. 1hr

Seminars:

1. Interlinking of River
2. Estimation of Evapotranspiration over land surface
3. Groundwater identification and estimation
4. Runoff computations
5. Attribution of Hydrologic Changes in a Tropical River Basin to Rainfall Variability.

Students take up group projects and deal with the following activities during the project. The project Report should contain the below gate process.

E Books:

1. Todd D.K., (2000) Ground Water Hydrology , John Wiley and Sons,
2. K., subramanya (2008) Engineering Hydrology, Tata McGraw-Hill Publishing Company Limited.
3. Ahmadi, A., Akhbari., M., and Karamouz, M (2011) Groundwater Hydrology: Engineering, Planning and Management, CRC Press.
4. Saeid Eslamian (2014) Handbook of Engineering Hydrology: Environmental hydrology and water management, CRC Press.
5. Malcolm. G. Anderson and Jeffrey J Mc Donnell (2005) Encyclopedia of hydrological Science, J Wiley.

Surveying Techniques

Code	Course Title	Credit	T-P-PJ
CUTM1067	Surveying Techniques	3	1-2-0

Objective:

To study the temporary adjustment of survey instruments by standard methods ,levelling and cross sectioning survey and setting out works.
To do various field works with the help of Total station.
To Carry out topographic survey

Learning outcome:

- Carry out temporary adjustment of survey instruments by standard methods ,levelling and cross sectioning survey and setting out works
- Carry out topographic survey
- Doing centering, leveling & measuring coordinate points of area and calculation, transfer to data from Total station to software spectrum link
- Doing field work using of simple machine parts such as Total –Station, Auto- level

Course outline:

Module-1(2Th) HRS

Historical survey practice: Introduction to surveying: Classification, Basic Principle, List of Instruments used in surveying.

Module-II (2Th+4Pr) HRS

Leveling: Concept and principles of levelling, different types of levelling, their application ,selection of station points, staff measurement locations, ideal location for etc. ,computation of Reduced levels through rise and fall method and height of collimation method, standard procedure for conducting leveling works , Identification of errors, understanding their source and rectifying the same ,different causes of errors in the leveling works, their impact on the project, procedure for laying slopes and gradients for roads, bridges, pipelines, canals etc ,errors in slope alignment and their implications, identification & rectifications ,procedures for making entries in the field book and make necessary calculations

Practices:

1. Calculation of RL using HI and Rise and fall method.
2. Longitudinal and cross sectional Leveling
3. Check Leveling

Module-III (2+5)HRS

Total station: Parts of the instrument, operational panel, guide light, basic key operation, display functions, setting up the instrument, focusing and target sighting, angle measurement, setting the horizontal, distance and angle measurement, REM measurement, coordinate measurement ,to view the data/ points collected, area calculation, data download.

Practices:

4. Distance, angle and slope Measurements
5. Traverse adjustment (With help of software)
6. Area calculation using Total station

Module-IV (1Th+5 Pr)HRS

Applications of total station :Detail survey i.e., data collection., Height measurement (Remove elevation measurement- REM,Fixing of missing pillars (or) Setting out (or) Stake out, Resection. etc. Remote distance measurement (RDM) or Missing line measurement (MLM).

Practices:

7. Height measurement (Remote elevation measurement- REM).
8. Fixing of missing pillars (or) Setting out (or) Stake out.

Module-V (1Th+3Pra) HRS

Concept of topographic survey, its importance and different methods of conducting topographic survey using modern and conventional instruments, calculations required for plotting contours, Interpretation and importance of contours. Knowledge of scale and key while plotting a contour map, represent topography of the area in required scale, different methods of computing levels.

Practice:

9. Preparation of contour maps using total station and surfer software.

Module-VI (2Th+4Pra) Hrs

Curves: Types of curves, Properties– simple, compound, reverse and transition curve. of works

Practices:

10. Setting out of different curves (simple, compound, reverse and transition) using Total Station

Module--VII (4 hours)

Setting out of works

11. Setting out of Building
12. Setting out of culvert

Text Books:

1. Surveying Vol I & II, III B C Purnima, Laxmi Publication.
2. Surveying, volume 1&2 BY S.K.Duggal, TMH publisher.

Reference Books:

1. Surveying & Levelling by T.P Kanitkar& V S Kulkarni

E Books:

1. Source of reference; NSQF

Online Source: NPTEL Videos (www.nptel.ac.in)

Geospatial Survey

Code	Course Title	Credit	T-P-PJ
CUTM1068	Geospatial Survey	3	1-2-0

Objective:

- To teach the basic concept of Geospatial Technology and to do various field works with the help of digital surveying instruments.
- To provide basics of digital surveying and mapping of earth surface using GPS, DGPS, GPR

Learning outcome:

- Gain knowledge about the structure of spatial data including file associations, attribute tables,
- Metadata, coordinate systems, and projections
- Carryout measurements Differential Global Positioning System (DGPS)/ Global Navigation
- Satellite System (GNSS) in the field.
- Preparation & digitization of different topography map with the help of Arc-GIS software
- Utility mapping using GPR

Module I: GIS(1Th+4Pra)Hrs

Geographic Information System: Introduction, Definition of GIS, Components of GIS, Geographical concepts, Input data for GIS Types of output products, Application of GIS Practice:
1. Introduction to GIS (Overview, Features, About the software, Main user interface, Main menu Project menu; Layer menu; View menu; Bookmarks menu; Plug-ins menu; Help menu, Toolbar, Legend window, Preview map, add data to the map area, Opening and saving projects)
2. Building a catalog of geographic data (Arc Catalog, folder connection, inside the catalog, folder location, create a working copy of the data, connect directly to your copy of the data, and remove folders that do not need)

Module II: GIS Data types (2Th+4Pra)Hrs

Introduction: GIS data types: Data representation: Data sources: Typical GIS data sets Data acquisition, Data verification and editing, Dereferencing of GIS data, Spatial data errors Spatial data models, Spatial data structures, Modelling surfaces , Modelling networks , GIS database and database management system
1. Introduction to Google Earth, Convert Shape file to KML Format, Extract data From Google Earth, Extract Point Data, Extract Polygon data, Extract line data, Convert KML File to shape file, overlaying an image into google earth

2. Exploring data and adding it to a map (The Contents tab, The Metadata tab, add a layer to a map, import metadata, Search for items, map compose)

3. Managing a dataset (Define a shape file's coordinate system, modify attributes in database tables, calculate attribute values in ArcMap, Update the table's metadata, create a layer using the related attributes, Add the vegetation type layer to the map)

4. ArcGIS Graphics language (generalization, symbology, and colour effect, change symbology and use transparency in creative ways)

Module III: Spatial Data Analysis (1Th+5Pra)Hrs

Spatial Data Analysis: Introduction, Data analysis terminology, Measurement of length, perimeter and area. Queries. Reclassification. Buffering and neighborhood functions. Data integration-map overlay. Spatial interpolation. Surface analysis. Network analysis. Digital terrain visualization

Practice:
1. Topology (Concept of topology, topology in different GIS format, Coverage, shapefile, DXF-Drawing Exchange File, Geodatabase, Topology principle, Topological Error and Correction process, creating personal Geodatabase, creating a features dataset)

2. Buffering and Editing tools: (Buffering in ArcGIS, add the data layer, create the buffer, conflation, extend the line, Erase point, Flip line, Snap, trim line, Densify, create a polygon, create point, Create polygon)
3. Creation DEM , DSM,TIN from SRTM/Cartosat Data

Module IV: Global Positioning System (2Th+3Pra)Hrs

Introduction of Global Positioning System, Satellite constellation, GPS signals and data, Geo-Positioning-Basic Concepts. Discussion on NAVSTAR, GLONASS, GALLILEO, COMPASS. Basic geodesy, Geoid /datum/ Ellipsoid-definition and basic concepts, Coordinate Systems, Special Referencing system, Map Scale, Scale factors, Indian geodetic System Segments of GPS:Control Segment, Space Segments, User Segment-operations of GPS, accuracy, error sources and analysis, methodology for collection of data, adjustment computations and analysis. Selection of datum, units and scale; GPS measurement. GPS Positioning Types-Absolute Positioning
Practice:

10.Setting of instrument, Observation, Data downloading and processing, Plotting of points, Georeferencing, Error calculation.

Module V: Differential Global Positioning System(2Th+3Pra)Hrs

Differential positioning Methods-Static & Rapid static, Kinematic-Real time kinematic Survey. DGPS-GPS data processing and Accuracy. Selection of Reference Station, Reference Station Equipment: GPS receiver, GPS antenna. Radio and its types, Radio Antenna GP. Application of GPS in Surveying and Mapping, Navigation, Military, Location Based Services, Vehicle tracking, etc. Limitation of GPS & DGPS

Practice:
11.Instrument Setup (Base station and Rover), Post-Processed Kinematic (PPK); Single point observation, Double point with baseline processing methods, Triangulation method, Real-Time Kinematic (RTK);Navigation system, Collection of Ground Control Point (GCP), Data export to GIS software.

Module VI: Ground Penetrating Radar(1Th+3Pra)Hrs

GPR Explain working principle of ground penetrating radar (GPR), Describe the type of antennas used with GPR for different type of underground material detection, Use ground penetrating radar until a predefined depth from sub-surface based on the conductivity of material. Explain use of sketch/single line diagram (SLD).Describe the use of GPS/DGP in sync with GPR to get all data populated on map. Describe the use of other Utility locator like electromagnetic locator and other utility locators
Practice:
12.Instrument setup, Utility mapping (Waterline, electric line, etc.), Processing of data

Module VII: (1Th+3Pra)Hrs

Explain GPR screen reading for the data being recorded, Describe the use of Roadometer with GPR to measure distance, Explain all the connecting cables used with GPR, Describe the power source and running capacity of GPR batteries, Explain handling the GPR and it's components, Describe how to transport GPR instrument, Use appropriate GPR antenna for described type of survey, Demonstrate the assembly of GPR equipment, Demonstrate the GPR data collection suing cross section .

Text Books:
1.Remote sensing and GIS 2nd Edition, Basudeb Bhatt, Oxford Publication
2. Anji Reddy, M. Remote sensing and Geographical information system, B.S. Publications, 20011.

Concrete Technology

Code	Course Title	Credit	T-P-PJ
CUTM1066	Concrete Technology	3	1-2-0

Course Objective:

To study properties of cement, sand and aggregate.
To determine the correct proportion of cement, sand and aggregate ratio for the concrete.
To perform tests for cement, sand and aggregate
To perform tests for concrete.
To supervise and monitor concrete casing and casting for building construction.

Learning Outcome:

Demonstrate test and analysis of cement, aggregate, sand, effect of water cement ratio.
Prepare concrete, carry out simple formwork and reinforcement with the application of modern Power Tools.
Prepare reinforcement of different R.C.C. members i,e, Foundation, beams, columns, slabs, Retaining Wall, etc.
Erect scaffolding and make the intricate formwork at different locations.
Prepare a bar bending schedule and demonstrate bar bending and calculate the estimated quantity of materials.
Make different types of arches and lintels with chajja.
Layout different types of vertical movement according to shape, location, materials by using stair, lift, ramp and escalator.

Course Syllabus

Module I : Aggregate/Sand (5hrs)

Theory:

Aggregate, classification (IS : 383), Grading, Characteristics (grading, fineness modulus), Bulking of fine aggregate, Deleterious substances, factors affecting the strength of concrete. Water, water quality, water requirement for hydration & workability, the effect of impurities present in water, Admixture, the meaning of terms, functions, classification, waterproofing and permeability reducing admixture. Construction Chemicals, Interpretation of specifications manufactures, Meaning of terms, functions, Classification (IS : 4082), waterproofing and permeability reducing admixture. (1hrs)

Practice:

1. Perform sieve analysis on aggregate and determine to grade. (01 hrs)
2. Determine the presence of silt and clay and Perform a test to determine bulking of sand. (01 hrs)
3. Specific Gravity, Water Absorption And Natural Course Of Fine & Coarse Aggregate. (1hr)
4. Aggregate Impact Test, Aggregate Crushing Test (1hr)

Module II: Preparation of Cement Concrete (3hrs)

Theory:-

Preparation of concrete Methods used, merits and demerits of methods, tools and equipment used and precautions to be taken for the following processes, batching, mixing, transportation, placing, compaction, curing, finishing, strength & durability requirements (IS : 456 - 2000), stripping of formwork, application of modern power tools, classification & specifications of concrete, classification of concrete according to grade, weight & methods of mixing ready mixed concrete, self-levelling concrete. (1hr)

Practice:-

Prepare concrete and lay at required places using power tools, (2hrs)

Module III: Workability of Concrete **(3.5hrs)**

Theory: Introduction to concrete, properties, workability of concrete (0.5hr)

Practice:

1. Workability of Fresh Concrete by (3hr)

(a) Slump cone method

(b) Compaction factor

(c) Flow table methods.

Module IV: Strength of concrete (7hrs)

Theory:

Nominal mixed and design mixed concrete, properties of concrete- workability & consistency, segregation, bleeding, strength, durability, impermeability, volume, stability, R.C.C. members for foundation, beams, columns, slabs, retaining wall etc. Scaffolding & formwork - Definitions of common technical terms used in Scaffolding, formwork. Types & applications Different materials used in formwork. Methods and tools used for formwork. Safety precautions to be observed in scaffolding and formwork Defects in formwork Shuttering /removal of formwork. Maintenance & repair of formwork Plain cement concrete (PCC) & Reinforced cement concrete. Properties of PCC & RCC in the green state and hardened state Importance of formwork and reinforcement in construction. (3hrs)

Practice:

1. Compressive strength of concrete (2hr)

(a) Cube Specimen

(b) Cylinder Specimen

2. Splitting tensile strength of cylinder. (2hr)

Module V : Design-mix concrete(5 hrs)

Principles of mix proportioning, probabilistic parameters, factors governing selection of mix. Road note - 4, DOE, ACI and IS method of concrete mix design, Variability of test results, acceptance criteria, various IS code provisions. (1hr)

Practice:

1. Preparation of design-mix concrete (2hr)
2. Concrete shotcreting (1hr)
3. Pressure grouting of concrete (1hr)

Module VI: Reinforcement in Concrete (5 hrs)

Theory:

Structural elements & characteristics (simply supported, continuous, fixed, cantilever, overhang), the importance of the use of reinforcement in concrete, tools used in bar bending correct use of tools, different operation in bar bending (straightening of bars, cutting of bars, bending of bars, placing of bars, binding of bars, fixing of cover blocks). (1hr)

Practice:

Making of shuttering & supports with uprights and wedges for Arches, Lintels and Lintels with Chajjahs. (2hrs)

Cutting, bending & placing of reinforcement. (2hrs)

Module VII: Special concreting techniques (7hr):

Theory:

Review of behavior and characteristics of high strength concrete, high performance concrete, fiber reinforced concrete, mass concrete, lightweight and heavyweight concrete, Precast concrete. Pumped concrete, concrete, underwater concrete, pre-placed concrete, vacuum dewatered concrete, hot and cold weather concreting, Ready mixed concrete. (3hr)

Practice:

1. Preparation of Lightweight concrete mix. (1hr)
2. Preparation of Fibre reinforced concrete. (1hr)
3. Preparation of concrete with solid wastes.(1hr)
4. Reactive Powder Concrete design. (1hr)

Reference: NSQF level 6

Electrical, Plumbing and Wood Works

Code	Course Title	Credit	T-P-PJ
CUTM1065	Electrical, Plumbing and Wood Works	3	1-2-0

Course Objectives

- To understand the installation for electrical systems in a building.
  To study carpentry work in the building, installation of doors, windows, etc.
  To understand and demonstrate installation of plumbing systems in the building.

Learning Outcomes

- Identify timber and perform sawing and planning using hand and power tools.
  Demonstrate surface finish with exact sizing by planning operation.
  Prepare different wooden Joints. (Range of skill - framing joint, Housing joints, broadening joints, Lengthening joints)
  Make small wooden job as per drawing with schedule sizes of timber or alternatives of timber i.e. FRP, MDF, FOAM using various hardware.
  Make different types of doors and windows with fixing of components.
  Demonstrate joining of electrical wire and carry out soldering, crimping observing related safety precautions.
  Demonstrate Electrical wiring with fixing of accessories conforming ISI rules (Range of skills - different types of Electrical wiring, joining of Fuses, fixing of MCB, a connection of lamp with switch and different fitting, etc.)
  Demonstrate installation of electrical appliances, Earthing and estimate costing of wiring
  Prepare a Simple pipe connection demonstrating cutting, joining of pipes with different methods using different types of fittings.
  Prepare layout of soil pipe and waste pipe with different types of sanitary fittings

Course Syllabus

Module I: Carpentry Tools (5 hrs)

Theory:

Defects in timber, diseases of timber, knots, shakes, grains, etc. Carpentry hand tools, measuring tools and uses. Work holding devices, power tools, viz. saws, drills, etc. Description of Carpentry Joinery, Planing, Moulding, Rebating, Chamfering, Sawing, Etc. Type of different planes and their proper uses in woodwork. Description, function and its size setting, knowledge of sharpening and uses, etc. knowledge of using marking gauges. Important instruments are necessary for checking flatness and twistness of the surface. Sharpening and grinding angle of the cutter. (2hr)

Practice:-

Identify different wooden sample pieces i.e.- softwood & hardwood, wooden grains, etc. & their applications Annual ring, knots, shakes & chicks, etc.). Demonstrate the application of hand tools, measuring tools, and work holding devices. Demonstrate the use of different power tools, viz. saws, drills, etc. Perform sawing, planning, Moulding, Rebating, Chamfering, etc. using different types of saws, and plains. Sharpen and set different type saw blades and planer blades/ cutters. (----2hrs)

Planning face, face edge, etc. Demonstrate the use of marking, mortise gauge, etc. Test the accuracy of flatness and twist-ness of the surface by using a try square. Demonstrate the use of winding strips, cross planning, edge planning. Demonstrate a portable power planer machine and its function. (---2 hrs)

Module II: Woodwork (5 hrs)

Theory:

Portable power planer - useful in modern woodwork and new technology design. Description of different types of joints. Uses of joint:- Framing joint angle joint and lengthening joint, housing joint, broadening joint, etc. Wood products - Industrial forms of timber - Veneer - Laminated sheet - Fibreboard - Hardboard - Plywood, Calculation of timber required for Wall Bracket. List the sequence of operations of the job. Doors –Parts, Location, standard sizes, types. Windows-types. Ventilators-purpose-types. (2hr)

Practice:

Make framing joint - Mortise and tenon Joint (Single and double, Plain hunched Mitre corner,) Make Housing joints - Full housing, Bridle, Stopped housing. Make broadening joints - Simple butt joint, Riveted butt joint, etc. Lengthening joints: End half-lap joint, End overlap joint, End bends lap joint, slopping scarf, racking scared, half lapping scarf, table scarf joint, etc. (---2hrs)

Make a joint on the hardwood to make a small frame. Stopped the Tenon & Mortise joint on the hardwood in the frame to set themselves. Make shelves by six pieces of hardwood with a single lapped half-lap dovetail joint with frame (two nos. of selves). (---2hrs)

Module III: Electrical Tools and Wiring (7hr)

Theory:-

Electrical Wiring:- Safety precaution and elementary first aid. Artificial respiration and treatment of electrical shock. Elementary electricity and its units. General ideas of the supply system. Wiremaṅs tools kit. Wiring materials. Electrical fittings. System of wirings. Wiring installation for domestic lightings. Conductor, insulator, semiconductor, cable joints, measurement of cable. Types of Fuses, MCB soldering, ELCB, RCCB, ABCB, MCCB AC and DC, AC fundamentals, polyphase types of electrical wiring Different Electrical wiring accessories, ISI rules of wiring Illumination. Earthing, types of earthing Earthing Pit. (1hr)

Practice:-

Prepare terminations of cable ends. Practice on skinning, twisting, and crimping. Identify various types of cables and measure conductor size using SWG and micrometer. (---1hrs)

Make a simple twist, married, Tee, and western union joints. Make Britannia straight, Britannia Tee, and rat tail joints. Practice in Soldering of joints/lugs. (---1hrs)

Demonstrate different electrical wiring systems with fixing of different accessories. Make electrical Fuse joints, fixing MCB.(---2hrs)

Module IV: Electrical Appliances (7hrs)

Theory

Different electrical appliances, accessories, Voltmeter. Estimation and costing of wiring. Explanation and working of different types of transformers and their classification. (1hr)

Practice:

Connect lamps with switches. Staircase circuit wiring. (---1hrs)

Install earthing in different positions. Install and connect electrical appliances and take a reading with Voltmeter. Prepare materials list and cost of wiring. (---1 hrs)

Identify transformer, test and use. (--1hrs)

Module V: Plumbing Tools (7hrs)

Theory:- Plumbing tools, materials used in plumbing, Different types of pipes, fittings and Joints - GI, PVC, AC, SW, CI, lead, steel - Properties and use in plumbing work. Method of cutting and joining of pipes. Drills - types and uses. Tap and Dies - types and uses, calculation of Tap drill size. (2hr)

Practice:-

Perform a Simple pipe connection using G.I. Pipes, socket, elbow, tee, reducing elbow, G.I. union, cap plug, reducer, Three face elbow, reducing socket, plug, G.I. nipple, etc. (2hrs).

Perform Joining of pipe with – thread joint, lead joint, flange joint, cement joint, D. Joint, etc. (---1 hrs)

Module VI Plumbing pipe fitting (7hrs)

Theory:

Sanitary Technical terms - sewer, sewage, sullage, etc. -Soil pipe and waste pipe fitting Different types of water closets Different types of urinal port Kitchen sinks, Bathtub, Washbasin. Water meter, installation of the water meter. Removal of airlock Purification of water Mineral matter, Hardness, Causes of Scale formation & their Removal. (1hr)

Practice:

Perform Joining of pipe with Elbow joint, socket joint, Tee joint, reducing elbow joint, floor trap joint, etc. (---1 hrs)

The layout of soil pipe and waste pipe to the sanitary fitting using different types of fitting viz. Door junction, door Bend, H.R. bend, Plain Bend, Double door junction, inverter junction, cowel , floor trap, Gully trap, P-trap etc. (---2 hrs)

Fitting of I.W.C with a high-level cistern. Fitting of the washbasin. Fitting of E.W.C. with a low-level cistern. Fitting a kitchen sink. Fitting of the bathtub. Fitting a urinal pot with an auto cistern. (---2hrs)

Module VII: Installations (5 hrs)

Theory:
Water Purification: Treatment plants for different groundwater contaminants, Treatment plants for surface water. Types of damages in taps, valves, water meter, and tanks - Method of rectification Water supply - Sources of water Storage of water Distribution of water Different types of valves used in Plumbing, Types of tanks R.C.C., P.V.C. Iron tanks etc. (1 hrs)

Practice:
Install a water meter. Remove the airlock. Determination of pH by pH meter. (----1 hrs)
Recondition taps, valves & flushing tank, test for correct functioning. Prepare a water supply pipeline system in residential buildings using different types of valves, fittings, and appliances. (---1 hrs)

Reference NSQF Level 5

Design of Structures

Code	Course Title	Credit	T-P-PJ
CUTM1074	Design of Structures	4	1-3-0

Course Objectives

To teach the basic theoretical aspects and contemporary issues in the design and fabrication of reinforced concrete members
To teach the basic fundamental behavior of different sections, bolts, members of steel structure used in construction.
To analyze and Design of Concrete Structures and Pre-Engineered Building(PEB) by using Software ETABS

Learning Outcomes

To gain the knowledge of RCC design calculation with relevant Indian Standards.

After completion of the courses the students will gain knowledge of Pre-Engineered design calculation with relevant Indian Standards

Students will develop the skill of converting client's requirements to structural drawing by using ETABS.

Course Syllabus

Course content (50 Hours)

Module I: Building Structural Frame (9 Hours):

Introduction to Reinforced Concrete, Mechanical Properties of Concrete, Flexural Analysis, Combined Flexure and Axial Load, Shear analysis. Limit State Method using Indian Standard Codes.

Practice:

1. Draw grids, Reference planes and joints, create new project models and introduction of the layout. (2hr)

2. Draw building structural frame and define material properties (4hrs)

Module II: Load definition to Building frame (5 Hours):

Modeling of Building, Load Calculations, Seismic weight, Base shear, Storey shear, Mass source, diaphragm, Meshing of Slab.

Practice:

3. Building structural frame- Define Properties, Material, Section, Mass source, Load pattern, load combinations

- Define Section Properties + Section Property Modifiers (1hr)
- Load Pattern (Gravity Loads + Earthquake (seismic) Loads (0.5hr)
- Wind Loads, Dead loads, super dead loads and live loads introductory(0.5hr)
- Define Load combination (Manual + Auto)(0.5hr)
- Meshing for Slabs, Walls, beams and Columns (0.5 hr)
- Assign Loads to structure as per IS Codes(0.5)
- Define Mass Source (For Lateral analysis)(0.5 hr)
- Pier Labels and Spandrel Labels for shell members such as shear walls and retaining RCC walls (1hr)

Module III: Analysis and check for Safety (10 Hours):

Analysis checks, Post design checks, Pushover analysis, response spectrum analysis, time history analysis.

Practice:

4. P Delta Analysis Check (How to include P-delta effects) (2hr)

5. Center of Mass and Center of Rigidity (and Building Eccentricity Check)(1hr)

6. Mass (Weight) Irregularity check as per the code (1hr)

7. Story Displacement, Story Drift checks as per code (1hr)

8. Torsional Irregularity check(1hr)

9. Modal Analysis Case [Eigen or Ritz Vectors], Time period (1hr)

10. Time History Analysis (2hrs)

Module IV: Reinforcement Detailing and scheduling (6 Hours):

● Reference of IS codes IS SP 34-1987 (Theory) (1hr)

● IS 13920-1993 Ductile Detailing of RC structures (Theory) (1 hr)

Practice:

11. Detailing of Beams, Columns and slabs using Autocad (4hr)

Module V: Design of Foundations using SAFE foundation (6 Hours):

Introduction to SAFE foundation, familiarizing tools used in SAFE foundation. Types of foundations introduction, isolated footing design, combined footing design and mat foundation design.

Practice:

12. Importing ETABS model file into the SAFE foundation software (0.5 hr)

13. design of isolated footing (1 hr)

14. design of combined footing (1 hr)

15. design of mat foundation (1 hr)

Module VI: Materials and Specifications of Steel/ Pre-Engineered Building (PEB) Structures (06 Hours):

PRE-ENGINEERED BUILDING COMPONENTS: Primary System: Main frames, Gable End Frame - Secondary frame system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases.

Practice:

16. DESIGN LOADS ON PRE-ENGINEERED BUILDINGS. Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads. Serviceability Limits as per code IS:800. (4hrs)

Module VII: PEB DESIGN METHODOLOGY (8 Hours):

Practice:

17. Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/tw, bf/tf ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations. Analysis and Design of Rigid Frames. Rigid Frame Moment Connection, Shear Connection- Anchor bolt and base plate design (Pinned and Fixed). (8hrs)

Text Books:

1. Reinforced Concrete design-S. N. Sinha. Tata McGraw-Hill, New Delhi

2. S K Duggal," Design of steel structures",2012.

3. S. Ramamurtham and R. Narayan," Design of steel structures" ,2014

Reference:
1. PEB design using ETABS

2. Etabs Full - Video

Road Engineering

Code	Course Title	Credit	T-P-PJ
CUTM1070	Road Engineering	3	1-1-1

Course Objectives

- To introduce transportation engineering principles with emphasis on designing principal element of highways along with the safe and efficient operation of highways.

Learning Outcomes

- Students will gain knowledge on planning, material selection for construction, Economics and finance and designing of elements on highway.
- Acquire the skill of designing the geometric elements of highway using CIVIL 3D software.

Course Syllabus

THE CLASSES WILL BE DELIVERED IN FLIP CLASS MOD

Module I: Highway introduction planning and development (1 hr)

Highway planning in India, development, rural and urban roads, road departments in India, road classification, road authorities i.e. IRC, NHAI, CRRI, NHDP etc.

Module II: Materials Characteristics and construction (6 hrs)

Introduction, physical and engineering properties of materials of pavement surfaces: Pavement quality concrete (PQC), Plain cement concrete(PCC), Hot Mix Asphalt (HMA), wearing courses, base, sub-base treated layers, types of bitumen, cutback bitumen, bitumen emulsion, tar, types of tar, bituminous mix design.

Practice Sessions:

Test on aggregate

Los angeles abrasion test.
Aggregate crushing test
Aggregate Impact value test
Specific gravity, water absorption, and bulk density

Test on bitumen

Penetration test of bitumen
Ductility value test of bitumen
Softening point test of bitumen
Flash and Fire point test of bitumen
Specific gravity of bitumen

Flakiness index and elongation index test of Aggregate

Test on mix design

Marshall Stability Test of bitumen

Test on subgrade

California bearing ratio test

Module III: Geometric design of roads (12 hrs)

Theory

Introduction to geometry design: Objective of geometric design, Design speed, cross-section elements, pavement surface characteristics-skid resistance, traffic volume, number of lanes, level of services, sight distance, horizontal alignment, vertical alignment, Superelevation, camber, cross-section, lane width.

Practice Sessions:

Design of Horizontal Alignment using CIVIL 3D software.
Design of Vertical Alignment using CIVIL 3D software.
Design of Superelevation using CIVIL 3D software.
Create a profile using CIVIL 3D software.

Module IV: Pavement Engineering (8 hrs)

Design of Flexiblepavements and Rigid pavements according to standards.

Practice Sessions:

Design of flexible pavements
Design of rigid pavement

Module V: Traffic Engineering(4 hrs)

Introduction to traffic engineering, road user characteristics, vehicular characteristics, various traffic studies and their application (field study), traffic signals, traffic signs and road marking, parking studies, traffic operations-accident prevention and safety methods, rotary intersection, ITS (intelligent transportation system)Various types of intersection and their design concept

Practice Sessions:

Junction design using civil 3d software
Vehicle volume counts (field study)

Module VI: Construction methodologies (3 hrs)

Cement Concrete Roads: Joints in pavements, Arrangement of joints, joint filler and sealer, Introduction, Components, I-Girder, Box culvert, VUP(Vehicle underpasses), PUP (Pedestrian underpasses), Road construction equipment, Machines used, Estimate a road project, PPP model.

Practice Sessions:

Estimate a road project

Module VII: Pavement evaluation and rehabilitation (1 hr)

Pavement failures, quality control causing deterioration and environmental factors, types of maintenance, maintenance of bituminous and concrete surfaces, roughness measurement, special repairs in pavements, strengthening and widening of an existing road.

Text Books:

k.khanna and C.E.G JUSTO, Highway engineering.
R Kadiyali, Traffic engineering and N B Lal, Principles and practice of highway engineering, Khanna Publications, 2005

Construction Materials

Code	Course Title	Credit	T-P-PJ
CUTM1064	Construction Materials	2	0-0-2

Course Objectives

- To introduce students to various materials commonly used in civil engineering construction and their properties.

Learning Outcomes

- **Knowledge:** Able to learn basic theory about main building- and construction materials.
- **Skills:** Able to make the right and well-founded choice of materials.
- **General competence**: Understand how properties of materials that are important in engineering can be related to the characteristics of the material.

Course Syllabus

THE CLASSES WILL BE DELIVERED IN FLIPCLASS MODE.

MODULE I: STRUCTURAL AND NONSTRUCTURAL MATERIALS (3 hrs)

Overview of Materials and Building/Structural Types, Factors Affecting Choice of Materials and Structural Form, Mechanical Properties, Non-Mechanical Properties (physical properties, durability), Individual Building Materials Manufacturing, Properties, Comparative Behavior, Structural Steel, Composition, Material Properties, and Behaviour, Non-ferrous metals.

MODULE II: STONES, BRICKS, CONCRETE BLOCKS (3 hrs)

Stone as a building material, Criteria for selection, Refractory bricks, Concrete blocks, Lightweight concrete blocks, Air Cleaning Bricks, Passive Cooling Ceramics or hydro ceramic bricks, Fly ash bricks, AAC, ECA, CLC blocks, EPS Building.

MODULE III: TIMBER, ROOF & FLOORING MATERIALS (4 hrs)

Timber, Market forms, Industrial Timber, Plywood, Mass timber, laminated timber and glue, laminated timber, Veneer, thermocol, Panels of laminates, Steel, Aluminum and Other Metallic Materials, Composition, Aluminium composite panel, Market forms, Mechanical treatment, Granite, Tile flooring, Cladding of tiles, materials according to types of roof, Elements of a pitched roof, Trussed roof, Steel Truss, Different roofing materials, R.C.C. Roof.

MODULE IV: NONSTRUCTURAL MATERIALS, ACCESSORIES, AND FINISHES (5 hrs)

Materials for doors and windows, Paneled door, Flush door, Collapsible door, Rolling shutter, PVC Door, Review of Nonstructural Materials and Criteria for Selection, Polymer Floor Finishes, Paints, varnishes, enamel, distemper, Tiles, Acoustic Treatment, Drywalls, Anchors, plumbing and sanitary fittings.

MODULE V: EXTERIOR WALL MATERIALS (4 hrs)

Gypsum Area Separation Walls, Insulated Vinyl Siding, Tilt, Up Walls, OVE Framing, ICF Walls, House Wrap Installation Tips, Common Cladding Alternatives, Insulated Wall Panels, WPC sheets, Cinder Block Walls, GFRG panels, Alusion panels,3D, printed bioplastics.

MODULE VI: NEW GENERATION CONSTRUCTION MATERIALS (4 hrs)

Glass, Ceramics, Sealants for joints, Fibre glass-reinforced plastic, Clay products, Refractories, Composite materials, Types, Applications of laminar composites, Fibre textiles, Geomembranes and Geotextiles for earth reinforcement, Illuminating Cement, Prefabricated panels, Bubble deck slab, Terracotta hollow brick, Cigarette Butts, Recycled cardboard, Sensitile, electrified wood, flexicombo, Richlite, liquid granite, carbon fibre, bendable concrete, concrete canvas, low e glass, transparent aluminum, paper insulation, Concrete, Masonry, Programmable Cement, Strand Rods, Concrete: Admixture, translucent concrete, FRP, Shotcrete, Epoxy resin, and grouting.

MODULE VII: GREEN AND SUSTAINABLE CONSTRUCTION MATERIALS (2 hrs)

Bamboo, Reclaimed wood, cork, mycelium, recycled steel, straw bales, rammed earth, hempcrete, grasscrete, GGBFS, CSF, geopolymer, Silica fume, Fly ash, Red Mud, copper slag, construction demolition waste, waste plastic.

Text Books:

1. Varghese.P.C,"Building Materials", PHI Learning Pvt Ltd, New Delhi, 2012.
2. Rajput. R.K., "Engineering Materials", S. Chand and company Ltd., 2008.

Water supply and Sanitary Engineering

Code	Course Title	Credit	T-P-PJ
CUTM1072	Water supply and Sanitary Engineering	3	1-1-1

Course Objectives

- To enable the students understand about the drinking water, sources, quality, demand, conveyance, water treatment, design of treatment units, Waste water treatment, STP and solid waste collection, treatment along with house plumbing and different sanitary fittings

Learning Outcomes

- To understand the principles of treatment units and their design units of drinking water, solid and liquid waste water treatment units; its recycle, reuse or disposal methods along with hands on practice of house plumbing and sanitary fittings

.Course Syllabus

Module 1: Sources, Quality and Demand of water (Three hours)

Importance and necessity of water supply Engineering; Sources of water; Suitability of water; Choice of source; Types of demand Population forecast; Computation of quantity of water; Fluctuation in demand; Factors affecting demand; Impurities in water; Collection of water sample; Physical Chemical and Biological tests; Standards of quality of water

Module 2 Treatment of water (Three hours)

Objectives of water treatment; Location of water treatment plant; Layout of water treatment plant; Basic principles of working of treatment plant; Various stages of treatment of influent water; ; Functioning of Coagulation treatment plant; Sedimentation; Filtration; Disinfection

Practice session (2Hours)

Practice 1: Predict Population from given field data by various methods

Practice II: Calculation of hardness of water from the observed field data

Module 3: Conveyance of Water (Three Hours)

Pumps and selection (out line only); Types of pipes used for conveyance; Pipe joints; Laying of Pipes; Distribution system; Types of valves; Types of Meters; Pipe fittings and fixtures of different materials their advantages and disadvantages; Necessity; Methods to prevent leaks; Measures for conservation of water

Practice session (2hours)

Practice III: Design lay out of pipe system from the overhead tank to different supply terminals.

Practice IV: **Laboratory works**: Determination of pH value, Turbidity and hardness of water sample

Module 4: Sanitation system (Four Hours)

Objective of sewage disposal; Methods of sewage collection; Conservancy system; Water carriage system; Classification of Drains; Sewer section; Sewer joint; Manhole; Flushing tank; Catch basin; Laying of sewer; Appurtenances and its locations; Maintenance of sewer; Procedure for maintenance of sewerage system; Causes of trouble and odor; Sewer cleaning operations; Requirements of maintenance; Functions of each maintenance equipment and tool; Safety measures for sewer-men

Practice session (2hours)

Practice V: Preparation of AUTOCAD layout plans/ sketches of different Water treatment plant, Sewage treatment plant, sedimentation tank, filters, Manholes, Flushing tanks etc.

Practice VI: Design of Septic tank using HEC software

Module 5: Sewage Treatment and Disposal (Two Hours)

Characteristics of sewage; Sampling of sewage; Treatment of sewage; B.O.D. Test, C.O.D. test; Methods of sewage disposal (STP)

Practice Session (2hours)

Practice VII: Design of Manhole from given field data

Practice VIII: Determination of B.O.D. and C.O.D. of waste water sample

Module 6: Plumbing gadgets and Sanitary fittings (Two Hours)

Plumbing tools; Pipes and pipe fittings; Fixing and jointing pipes and accessories; Traps; House drainage plant; Plumbing practice and operations; Safety and precautions; Sanitary fittings

Field Visit: Four hours

Water treatment plant and a sewage treatment plant must be followed by a field Visit report

Module 7: Recycling and disposal of Waste Water and Solid Waste (Three Hours)

Sewage Treatment plant; Different recycling method with respect to quality of waste water; Utilization and management of solid waste;

Seminar: (Two hours)

The students are made groups and topics related to water supply, Municipal/rural waste disposal system, storm water disposal and Sewerage disposal systems

Suggested Reading

1. Text Book of water supply and sanitary Engineering ; S K Hussain : Oxford and IBH
2. Water supply & Sanitary Engg; : Vazirani & Chandola :Khanna Publishers
3. Municipal and Rural Sanitation :Ehlers & Steel :Mc Graw hill book
4. Elements of Public Health Engineering. :K.N.Duggal :S.Chand & Co.

Computer Aided Engineering

Code	Course Title	Credit	T-P-PJ
CUTM1081	Computer Aided Engineering	3	**0-2-1**

Objective

- This course will help student to use structural scenario, thermal scenario and to do Structural analysis and Thermal analysis of various problems.

Learning outcome

- Create complete finite element models
- Submit and monitor analysis jobs
- View and evaluate simulation results

Course content

Module I: Material and Selection Properties (6 Hrs)

Property Module, Material Definitions, Linear Elasticity, Large Strain Elasticity, Metal Plasticity, Material Calibration, Material Databases, Section Properties

Practice:

1. Analysis of crack in pressure vessel
2. Cable stayed bridge simulation

Module II: Element Selection Criteria (6 Hrs)

Solid Element Selection, Structural vs. Continuum Elements, Modeling Bending UsingContinuum Elements, Stress Concentrations

Practice:

3. Stress analysis of rail road with wheel.
4. Bike frame structural analysis

Module III: Meshing (8 Hrs)

Mesh Module, Mesh Elements Mesh Generation Workflow, Local Fine-tuning
Quality Checks, Mesh Compatibility, Mesh Convergence, Dependent and Independent Part Instances

Practice:
5. Airplane bracket structural analysis
6. Structural analysis of wind turbine blade

Module IV: Boundary Condition **(6 Hrs)**

Step Module, Analysis Steps and Procedures, Output Requests, Output Files
Load Module, Loads and Boundary Conditions, Initial Conditions

Practice:
7. Generative structural analysis applied for design optimization
8. Stress analysis on a backhoe

Module V: Contact **(6 Hrs)**

Mechanical Contact Properties, Contact Domain, Contact Formulation and Controls, Handling Initial Over closures, Contact Output

Practice:
9. Analysis of Economizer.
10. Analysis of Screw Jack

Module VI: Analysis Procedures **(6 Hrs)**

Model and Analysis Steps, Analysis Procedures, The static, general analysis procedure, Finding a converged solution, The Static, Linear Perturbation procedure, Buckle procedure, Frequency Procedure, The dynamic, explicit analysis procedure, Stability Limit, Analysis Continuation Techniques

Practice:
11. Steady state analysis of a composite bar.

Module VII: Thermal Analysis **(8 Hrs)**

Steady State Heat Transfer, Transient Heat Transfer, Thermal Interfaces, Thermal Stress Analysis

Practice:
12. Temperature distribution in radiators used in automobiles
13. Oven radiation simulation
14. Steady state thermal analysis of tungsten coil with internal heat generation
15. Thermal analysis of disc brake

Projects

1. Thermal Analysis of PV Solar Pannel
2. Structural and thermal analysis of Green House
3. Structural analysis of Quadcopter.
4. Structural analysis of landing gear.
5. Numerical study on different types of fins.
6. Overhead tank failure analysis.
7. Analysis of Rocket Nozzle
8. Analysis of BAJA SAE
9. Structural and Thermal Analysis of Downdraft Gasifier
10. Structural and Thermal Analysis of Stirling Engine
11. Structural Analysis of Hydraulic Press
12. Structural Analysis of Elevating Conveyor

Text Books/ Reference Books/ Reference Material

1. SIMULIA: 3DS Learning Space

Source of reference: 3DS peer learning

Hydraulic Machinery

Code	Course Title	Credit	T-P-PJ
CUTM1090	Hydraulic Machinery	2	1-1-0

Objective

- To emphasizes Principle of operation of hydraulic machines and their system design
- To familiarize their huge applications in different industries

Learning outcome

- After completion of the course, the students will have a strong foundation on the pertinent equations to engineering design of the machines for required applications.
- Students will learn to determine performance characteristics of fluid machinery by using various simulation tools

Course content

Module I: Principle of Operation of Hydraulic Machinery (2 hrs)

Introduction to hydraulic machines: Classification and operation principle, Euler equation for turbo machines: net head developed by pump and Turbines

Module II: Radial and Axial flow pumps (8 hrs)

Velocity triangle of pumps, effect of inlet swirl on velocity triangles, Constructional features of Centrifugal Pump, design aspect, working principle and efficiencies, work done by the impeller, priming, specific speed, NPSH, effect of swirl on the cavitations, working principle and design aspect of gear oil pump.

Practice:

1.Flow analysis of fluid of Centrifugal pump through Simulia software

2. Flow analysis of gear oil pump through Simulia software

3.Performance Characteristics of Centrifugal Pump through Virtual lab

Module III: Positive displacement Pumps (3 hrs)

Working principle of Reciprocating Pump, discharge, works done and power requirement, ideal indicator diagram, and slip, characteristic H-Q curve of positive displacement pump

Practice:

4. Performance Characteristics of Double Acting Reciprocating Pump through Virtual lab.

Module IV: Hydraulic Turbine: Impulse Turbine (6 hrs)

Classification, definitions of heads and efficiencies, Pelton Wheel - Construction and working principle, work done and hydraulic efficiency, design aspects.

Practice:

5. Simulation of Pelton Turbine through simulia software
6. Performance Characteristics of Pelton Turbine through Virtual lab.

Module V: Hydraulic Turbine: Reaction Turbine (6 hrs)

Reaction turbine (Francis, Kaplan) -Components, working principle, work done and efficiency, draft tube, specific speed, cavitations

Practice:

7. Performance Characteristics of Francis Turbine Simulia software.
8. Simulation of Kaplan turbine through Virtual lab.

Text Books:

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, ninth edition

Reference Books:

1. P.N. Modi & S.N. Seth, Hydraulics & Fluid Mechanics, Rajsons Publications Pvt. Ltd, Twentieth Edition

Source of reference;

1. https://nptel.ac.in/course.html
2. www.vlabs.ac.in

Fluid Mechanics with Finite Volume Method

Code	Course Title	Credit	T-P-PJ
CUTM1089	Fluid Mechanics with Finite Volume Method	3	2-1-0

Objective

- To learn To learn fundamentals of computational methods like FVM for solving linear and non-linear partial differential equations related to fluid dynamics
- To emphasizes the basic underlying fluid mechanical principles governing energy transfer in a fluid flow systems with their performances in different field of engineering applications

Learning outcome

- After completion of the course, the students will able to evaluate finite difference/volume schemes on model problems of computational fluid dynamics.
- Students will learn to develop steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems

Course content

Module I: Introduction to Finite volume Method (6 hrs)

Fundamentals of Finite volume methods, different types of finite volume grids, approximation of surface and volume integrals; interpolation methods, Review of governing equations, Classification of governing equations , Staggered and co-located formulation

Practice:

1. 2D mapped Mesh for rectangular pipe
2. 2D mapped Meshing for Aerofoil.

Module II: Grid generation (6 hrs)

Grid generation, creating, updating and managing meshes, Steady diffusion equation on structured meshes, Unsteady diffusion equation on structured meshes, Linear system solvers, finite volume discretization of steady and unsteady diffusion equation, Finite volume discretization of convection-diffusion problem

Practice:

3. 3D structure mesh of Circular Cylinder
4. 3D unstructured mesh with primes layers for Aerofoil
5. 3D coarse/ medium/ fine sweep mesh for pipe

Module III: Incompressible flow field calculation with finite volume method (5 hrs)

Navier-stokes equation, Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocated grid solutions of Navier-stokes equation with finite volume method, boundary condition, Reynolds averaged Navier-Stokes equations.

Module IV: Fluid kinematics (2 hrs)

Types of flow, Continuity equation (in one, two& three dimension steady state fluid flow analysis with finite volume method, velocity and acceleration fields, streamline, streak line, path line, velocity potential function and stream function, Rotation and vorticity.

Module V: Fluid Dynamics with Finite volume method (4 hrs)

Lagrangian and Eulerian Approach, Euler's equation of motion along a stream line for ideal flow, Principle of conservation of energy with finite volume method, Integration of Euler's equation along a stream line, Bernoulli's equation

Practice:

6. Fluid Analysis of Bernoulli's equation: Flow in a contracting pipe through CFD simulation

Module VI: Flow through Pipes (5 hrs)

Reynolds's Experiment, Laws of Laminar and Turbulent Friction, Introduction Turbulence modeling through Finite volume method, Hagen Poiseulle Equation for laminar flow through pipe, Darcy-Weisbach Equation for Turbulent flow through pipe.

Practice:

7. Fluid Analysis of Laminar flow in 3D Circular Pipe through CFD simulation
8. CFD Simulation of the Water Flow Passing Through a Converging Pipe.
9. CFD Analysis to determine the frictional losses in the pipe.

Module VII: Flow Measurement (5 hrs)

Flow through small orifice meter, Mouthpiece, Velocity Measurement using Pitot tube, Prandtl tube, Flow measurement in pipes-Flow, Venturi Meter, Flow rate Measurement in channel- Weir and Notches

Practice:

10. CFD Analysis of Fluid flow through Orifice meter
11. CFD Analysis of Fluid flow through adjustable channel
12. CFD Analysis of Fluid flow simulation through Venturi Meter

Text Books:

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, ninth edition

Reference Books:

2. P.N. Modi & S.N. Seth, Hydraulics & Fluid Mechanics, Rajsons Publications Pvt. Ltd, Twentieth Edition

Source of reference;

3. https://nptel.ac.in/course.html
4. https://nptel.ac.in/courses/112/105/112105218/
5. https://nptel.ac.in/courses/112/105/112105183/
6. https://nptel.ac.in/courses/112/105/112105182/

Theories of Failure Using Finite Element Analysis

Code	Course Title	Credit	T-P-PJ
CUTM1062	Theories of Failure Using Finite Element Analysis	4	2-2-0

Objective

- To educate the students on basic theories behind mechanics of solids.
- To educate the students on Finite Element Analysis concept applicable to Practical conditions.
- To educate the students on Failure Criterion which will be useful for designing Practical problems.
- To educate the students on using 3D Experience Tools for analysis of various mechanical structures and load transmitting elements.

Learning outcome

- Students will have knowledge and practical engineering skills in analysis of mechanical strength of structures and load transmission elements and will be able to design them based on input data.
- Students will be able to deploy 3D Experience Platform to develop design solutions.
- Students will be able to apply the Concept of Meshing and Failure Criteria to Practical Problems which will lead Economical and safe in Design Aspect.

Course content

Module I Introduction to Finite Element Analysis (FEA) and 3D Experience Platform - (4(T)+5(P)) (9 Hours)

Introduction to FEA: Need for Studying FEA; Types of Analysis; Discretization of a Structure; Element Shapes, Nodes and Degrees of Freedom; Mesh Refining, Element Aspect Ratio, Use of Symmetry, Principle of Convergence; General Procedure of FEA.

Material failure Behaviour: Stress–Strain Diagrams for Ductile and Brittle Materials. Equivalent stresses for varying orientations, Principal stresses, maximum shear stress, Mohr's circles.

Practice:

1. Introduction to 3D Experience Platform: About the Apps and their Applications from Engineering Point of View.
2. Analysis of Steel Bridge – Simulation using 3D Experience Tool.
3. Tensile Test using Simulation 3D Experience Tool.
4. Stress Strain Curve of a Ductile Material (Mild Steel) using Universal Testing Machine

Module II Mesh Generation and Modeling of Truss Structure (1(T)+ 4(P) (5 Hours)

Mesh Generation and Methods of Meshing and Types of Meshing. Procedure for selecting the

method of meshing and type of meshing.Importance and application of Stiffness Matrix for different types of elements and the procedure for getting the results.

Practice:

5. 3D Experience Simulia – Modelling and Meshing of Transmission line tower.

Module III Stresses and Deflection Criteria: (5(T)+ 4(P) (9 Hours)

Procedure for Drawing Shear Force and Bending Moment Diagrams, Point of Contra Flexure.

Stresses (No Derivation): Simple or Pure Bending, Flexure Formula, Section Modulus, Neutral Axis, Determination of Bending Stresses, Shear Stress Distribution for Different Sections.

Deflection : Equation of Elastic Curve, Direct Integration Method

Practice:

6. 3D Experience Simulia – Modelling and Finite Element Analysis of Framed Structure subjected Earthquake Loads.

Module IV: Theories of Failure: (2(T)+ 4(P) (6 Hours)

Theories of Failure: Failure Under Biaxial Loading, Rankine's Theory, Guest's or Tresca's Theory, Von Mises Theory, Graphical Representation of Failure, Safety Factors, Prevention of Failure in Design Stage, Diagnosis of Failure In Post-Manufacturing Stage.

Practice:

7. 3D Experience Simulia: Bicycle Frame Structural Analysis

Module V: Torsion: (3(T)+ 4(P) (7 Hours)

Torsion: Torsion Equation, Design of Shafts, Power Transmitted by Shafts, Composite Shafts, Combined Bending and Torsion, Closed-Coiled Helical Springs, Spring Connected in Series and Parallel.

Dynamic Analysis: Fundamentals of Vibration; Evaluation of Natural Frequencies and Mode Shapes (Eigen values and Eigenvectors); Non-linear Analysis, Fatigue Analysis. Structures Subjected to Blast Loads.

Practice:

8. Simulation: Static and Dynamic Analysis of Shaft

Module VI Pressure Vessels (1(T)+ 2(P) (3 Hours)

Longitudinal and Hoop Stress in Thin-walled Pressure Vessels Subjected to Internal Pressure.

Practice:

9. Simulation: Crack Analysis of Thin walled Pressure Vessels.

Module VII Fatigue and Fracture: (3(T)+ 4(P) (7 Hours)

Fatigue: Failure Under Cyclic Loading, Endurance Limit. S-N Curve, Stress Concentration, Goodman and Soderberg Criteria.

Fracture: Types of Failure, Brittle and Ductile Fracture, Basic Modes of Fracture. Griffith's Analysis, Crack Growth and Stress Intensity Factor.

10. Fatigue Analysis of Crankshaft of Two-Wheeler

Text Books:

1. Strength of Materials, S.S. Rattan, Tata Mc-Graw Hill Publication.
2. Advanced Mechanics of Materials, A.P. Boresi and R.J. Schmidt, Willey India

Disaster Preparedness & Planning Management

Code	Course Title	Credit	T-P-PJ

CUTM1907	Disaster Preparedness & Planning Management	2	2-0-0

The overall aim of this course is to provide broad understanding about the basic concepts of Disaster Management with preparedness as a Civil Engineer. Further, the course introduces the various natural hazards that can pose risk to property, lives, and livestock, etc. andunderstanding of the social responsibility as an engineer towards preparedness as well as mitigating the damages.

Course objectives of the course are i) To Understand basic concepts in Disaster Management ii) To Understand Definitions and Terminologies used in Disaster Management iii) To Understand Types and Categories of Disasters iv). To Understand the Challenges posed by Disasters vi) To understand Impacts of Disasters Key Skills

Outcomes: The student will develop competencies in ¬ the application of Disaster Concepts to Management ¬Analyzing Relationship between Development and Disasters. ¬ Ability to understand Categories of Disasters and ¬ realization of the responsibilities to society

Syllabus

Module 1:Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation).

Module 2:Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Module 3:Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Module 4:Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Postdisaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Module 5:Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse

changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text/Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)

2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003

7. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC