Centurion University of Technology and Management Odisha

Choice Based Credit System

Course Structure & Syllabus

Civil Engineering

School of Engineering & Technology

2022

Basket-IV

Core Courses

Civil Engineering

Course Code	Course Title	Credit	Type (Theory+Practice+Project)
CUTM1073	Geotechnical Engineering	3	1-1-1
CUTM1061	Structural Detailing and Drawing	2	0-2-0
CUTM1063	Quantity Estimation & Costing	3	2-1-0
CUTM1060	Geometric Modeling	3	0-3-0
CUTM2372	Hydrology and Irrigation	3	1-2-0
CUTM1066	Concrete Technology	3	1-2-0
CUTM1065	Electrical, Plumbing, and Woodwork	3	1-2-0
CUTM2374	Design of Structures	4	2-2-0
CUTM2368	Construction Materials	2	0-2-0
CUTM2373	Water Supply and Sanitary Engineering	2	1-1-0
CUTM1081	Computer-Aided Engineering	3	0-2-1
CUTM1090	Hydraulic Machinery	2	1-1-0
CUTM1089	Fluid Mechanics with FVM	3	2-1-0
CUTM1062	Theories of Failure analysis using FEA	4	2-2-0
CUTM1059	Database Management Systems	3	2-1-0
CUTM1058	Programming in Java	3	2-1-0
CUTM1907	Disaster Preparedness & Planning Management	2	2-0-0
CUTM2369	Surveying Technique	3	1-2-0
CUTM2370	Analysis of Structure	4	2-2-0
CUTM2371	Transportation Engineering	3	2-1-0
	Total Credits	**58**	

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.

Course 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 1: INTRODUCTION (5hrs)

Soil formation - soil structure and clay mineralogy - Adsorbed water - Mass- volume relationship - Relative density.

Grain size analysis - Sieve and Hydrometer methods - Consistency Limits and Indices - I.S. Classification of soils

Practice Sessions:

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 2: PERMEABILITY & SEEPAGE THROUGH SOILS (6 hrs)

Soil water - capillary rise - flow of water through soils - Darcy's law- permeability - Factors affecting - Determination of coefficient of permeability - Permeability of layered systems.

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

Practice Sessions:

4. Determination of Atterberg limits of soil: (a) liquid limit, (b) plastic limit, (c) shrinkage limit (2 hrs)
5. Measurement of unit weight of soil in the field: (a) Core cutter method, (b) Sand replacement method (2 hrs)

Module 3: BCOMPACTION & CONSOLIDATION (5hrs)

Mechanism of compaction - factors affecting - effects of compaction on soil properties. Field compaction Equipment - compaction control.

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

Practice Sessions:

6. Determination of field density by sand replacement method. (1hrs)
7. Determination of consolidation properties of soils. (1:15mins)
8. Determination of unconfined compressive strength of soil (1:15mins)

Module 4: SHEAR STRENGTH & STRESS DISTRIBUTION OF SOILS (6hrs)

Mohr - Coulomb Failure theories, Normal and shear stresses on a plane, Boussinesq's solution.

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 5: DESIGN OF SHALLOW & DEEP FOUNDATIONS **(7hrs)**

Introduction, Different types of shallow foundations, Different types of deep foundations, Design methodology for piles.

Practice Sessions:

9 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 6: FOUNDATIONS IN DIFICULT GROUNDS **(4:30 hrs)**

Introduction, Techniques of ground improvement, Foundations in swelling soil, Foundations in collapsible soil, Use of soil reinforcement, machine foundations, Free and forced vibration, Lysmer's method, dynamically loaded foundations, Dynamic soil properties, Vibration isolation. **BASIC APPRAISAL ONLY.NO NUMERICAL PROBLEMS**

Practice Session:

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

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

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

Module 7: EARTH PRESSURE & RETAINING STRUCTURES **(2hrs)**

Types of Earth pressure. Rankine's Active and passive earth pressure, Smooth Vertical wall with horizontal backfill. Extension to Soil, Coulombs wedge theory, 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.

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.

Course 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:

Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.

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.

Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008

References:

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

Publication of Bureau of Indian Standards:

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

Course 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 1: BUILDING (2 Hrs)

Reading of Plans, Sections and detailed Drawings Related to buildings; preparation of Quantities and Units. Introduction of estimating & different types of estimates - 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 2: CULVERT (2 Hrs)

Estimations and Quantity Surveying: Reading of Plans, Sections and detailed Drawings

Related to irrigation structures; preparation of Quantities and Units.

5. Detailed estimates for a Slab culvert with right angled/ Splayed wing wall. (01 Hr)
6. Detailed estimates (Manual) for a box culvert. (01 Hr)
7. Detailed estimates (Manual) for a Hume pipe Culvert. (01 Hr)

MODULE 3: ROAD (2 Hrs)

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

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

MODULE 4: 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.

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

MODULE 5: QUANITY SURVEY (2 hrs)

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

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

MODULE 6: RATE ANALYSIS OF BUILDING (2 hrs)

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

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

MODULE 7: RATE ANALYSIS OF CULVERT & ROAD (2 Hrs)

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

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

MODULE 8: PROJECT PREPARATION **(2 Hrs)**

19. Road section C & L-section. (01 Hr)
20. 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.

Course 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 (4Hrs)

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 (3 Hrs)

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

MODULE 3: BUILDING PLAN AND TRUSS (4 Hrs)

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

MODULE 4: INTRODUCTION OF REVIT ARCHITECTURE (3 Hrs)

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

MODULE 5: 3D MODELING WITH RIVET (7 Hrs)

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

MODULE 6: WORKING WITH PROJECT AND WORK PLANES (4 Hrs)

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

MODULE 7: ANNOTATION AND DETAILING AND RENDERING (4 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
CUTM2372	Hydrology and Irrigation	3	2-1-0

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.

MODULE I: INTRODUCTION (2 hrs+1hrs)

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

Practice Session: (1hr)

1. Determination of infiltration capacity using double ring infiltrometer. 1hr

MODULE II: HYDROGRAPH (3hr+2hr)

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.

Practice Session:(2hr)

2. Construction of double mass curve using Python. 1hr

3. Hydrograph analysis using Python. 1hr

MODULE III: FLOOD MANAGEMENT (1hr+2hr)

Floods- type and causes of occurrence, flood classification- probable maximum flood, standard project flood, design flood, Flood forecasting, Flood routing-channel routing, Flood protections.

Practice Session:(2 hr)

4.Determination of flood stage-discharge relationship in a watershed using python. 1hr

5.Determination of flood peak-area relationships using python. 1hr

MODULE IV: GROUND WATER HYDROLOGY (1hr+2hr)

Ground water flow: Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, types of aquifers, radial flow into a well under confined and unconfined conditions (only steady state conditions), Yield of a well, Borewell.

Practice Session:(2hr)

6.Exploration of Ground water using Electrical Resistivity Method.2hr

MODULE V: HYDROPOWER ENGINEERING (2hr+4hr)

Dams and their causes of failure**,** economical height of dam, planning of water resources projects, Reservoir Planning: Storage capacity of reservoirs, Yield from reservoir, Reservoir losses, reservoir sedimentation.

Practice Session:(4 hr)

7.Design of Stability analysis of gravity dam. 2hr

8.Various cases of Failure of concrete gravity dam.2hr

MODULE VI: IRRIGATION ENGINEERING (1hr+2hr)

Water requirements of crops, consumptive use, quality of water for irrigation, irrigation methods and their efficiencies.

Practice Session: (2hr)

9.Numerical analysis of Irrigation Parameters (Duty, Base Period, Delta and Efficiencies).2hr

MODULE VII: CANAL IRRIGATION (3hr+5hr)

Classification of canals, Canal losses, Alignment of main and distributary canals, most efficient section, Cross section of irrigation canals, water logging - causes and control.

Practice Session:(3hr)

10 Design of irrigation canal using Kennedy's and Lacey's theory. 2 hr

11 Design of lined canal. 1hr

12 Design of head regulators and cross regulators. 2hr

13. Field visits for various irrigation structures.

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.

Concrete Technology

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

Course objective

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

Course 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.

COURSE SYLLABUS

MODULE 1: AGGREGATE/SAND (5hrs)

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 Session:

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 2: PREPARATION OF CEMENT CONCRETE (3hrs)

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 Session:

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

MODULE 3: WORKABILITY OF CONCRETE (4 hrs)

Introduction to concrete, properties, workability of concrete (1 hr)

Practice Session:

6.Workability of Fresh Concrete by (3hr)

(a) Slump cone method

(b) Compaction factor

(c) Flow table methods.

MODULE 4: STRENGTH OF CONCRETE (7hrs)

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 Session:

7.Compressive strength of concrete (2hr)

(a) Cube Specimen

(b) Cylinder Specimen

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

MODULE 5: 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:

9.Preparation of design-mix concrete (2hr)

10.Concrete shotcreting (1hr)

11.Pressure grouting of concrete (1hr)

MODULE 6: 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:

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

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

MODULE 7: 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:

14.Preparation of Lightweight concrete mix. (1hr)

15.Preparation of Fiber reinforced concrete. (1hr)

16.Preparation of concrete with solid wastes. (1hr)

17.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 objective

- 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.

Course outcomes

- Identify timber and perform sawing and planning using hand and power tools.
- Demonstrate surface finish with exact sizing by planning operation.
- 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.

Course Syllabus

MODULE 1: CARPENTRY TOOLS (5 hrs)

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 Session:

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 2: WOODWORK (5 hrs)

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 Session:

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 3: ELECTRICAL TOOLS AND WIRING (7hr)

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 Session:

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 4: ELECTRICAL APPLIANCES (7hrs)

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

Practice Session:

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 5: PLUMBING TOOLS (7hrs)

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 Session:

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 6: PLUMBING PIPE FITTING (7hrs)

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 Session:

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 7: Installations (5 hrs)

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 Session:

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
CUTM2374	Design of Structures	4	2-2-0

Course objective

- 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

Course 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

MODULE 1: BUILDING STRUCTURAL FRAME (9 Hrs):

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 Session:

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 2: LOAD DEFINITION TO BUILDING FRAME (5 Hrs):

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

Practice Session:

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

4. Define Section Properties + Section Property Modifiers (1hr)

5. Load Pattern (Gravity Loads + Earthquake (seismic) Loads (0.5hr)

6. Wind Loads, Dead loads, super dead loads and live loads introductory(0.5hr)

7. Define Load combination (Manual + Auto) (0.5hr)

8. Meshing for Slabs, Walls, beams and Columns (0.5 hr)

9. Assign Loads to structure as per IS Codes (0.5)

10. Define Mass Source (For Lateral analysis (0.5 hr)

MODULE 3: DESIGN OF BEAMS, COLUMNS AND SLABS ACCORDING TO IS CODES (10 Hrs)

Application of limit state method to rectangular beams for flexure, shear, bond and torsion,

11. Design of doubly reinforced beams, design of T and L beams, [manually as well as in ETAB software]

12. Design of one way and two-way slabs. [manually as well as in ETAB software]

13. Design of short and long columns with axial and eccentric loadings, [manually as well as in ETAB software]

MODULE 4: REINFORCEMENT DETAILING AND SCHEDULING (6 Hrs):

- Reference of IS codes IS SP 34-1987 (Theory) (1hr)
- IS 13920-1993 Ductile Detailing of RC structures (Theory) (1 hr)

Practice Session:

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

MODULE 5: DESIGN OF FOUNDATIONS USING SAFE FOUNDATION (6 Hrs):

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 Session:

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

16. design of isolated footing (1 hr)

17. design of combined footing (1 hr)

18. design of mat foundation (1 hr)

MODULE 6: MATERIALS AND SPECIFICATIONS OF STEEL/ PRE-ENGINEERED BUILDING (PEB) STRUCTURES (6 Hrs):

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 Session:

19. 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 7: PEB DESIGN METHODOLOGY (8 Hrs):

Practice Session:

20. 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

Construction Materials

Code	Course Title	Credit	T-P-PJ
CUTM2368	Construction Materials	2	0-2-0

Course objective

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

Course 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

MODULE 1: 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 2: 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 3: 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 4: 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 5: 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 6: 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 7: 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
CUTM2373	Water supply and Sanitary Engineering	2	1-1-0

Course objective

- 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

Course outcomes

- To understand the principles of treatment units and their design units of drinking water, solid and liquid waste water treatment units; it recycles, 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 (3 hrs)

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 (3hr+2 hrs)

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 (2 hrs)

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 (1hr+4 hrs)

Pumps and selection (outline 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 **(4 hrs)**

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 **(2hr+4 hrs)**

Objective of sewage disposal; Methods of sewage collection; Conservancy system; Waste carriage system; Classification of Drains; Sewer System (Manhole; Flushing tank; Catch basin etc.)

Practice session **(4 hrs)**

Practice V: Preparation of AUTOCAD layout plans/ sketches of different Water treatment plant, Sewage treatment plant, sedimentation tank, filters, Manholes, Flushing tanks etc. 2hr

Practice VI: Design of Septic tank using HEC software 1hr

Practice VII: Design of Manhole from given field data1hr

Field Visit: 4 hours

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

MODULE 5: WASTE MANAGEMENT **(3hr+2 hrs)**

Sewage Treatment plant; Treatment of sewage; Types of waste, sewage and sludge disposal (Solid, liquid, Radio Active), Utilization and management of solid waste.

Practice session **(2 hr)**

Practice VIII: Determination of B.O.D. and C.O.D. of waste water sample 2hr

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.

Course 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)**

*S*teady 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

Course 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

Course 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
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.

Course 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.

Practice:

1. Introduction to 3D Experience Platform: About the Apps and their Applications from Engineering Point of View.

Module II Mesh Generation and Modeling of Truss Structure (1(T)+ 3(P) (4 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 a beam element.

Module III Stresses Criteria: (4(T)+ 4(P) (8 Hours)

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

Practice:

6. Drawing SFD and BMD different beams with various boundary condition.

Module IV:Stresses (No Derivation): (7 Hours)

Simple or Pure Bending, Flexure Formula, Section Modulus, Neutral Axis, Determination of Bending Stresses, Shear Stress Distribution for Different Sections

Module V. Bending and Shear Stresses in Beams: (7 Hours)

Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre(only concept)

Module VI Theories of Failure: (6 Hours)

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.

Module VII: Material failure Behaviour: (7 Hours)

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

Practice:

Tensile Test using Simulation 3D Experience Tool.

Stress Strain Curve of a Ductile Material (Mild Steel) using Universal Testing Machine

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

Reference Books:

1. Elements of Fracture mechanics, Prashant Kumar, McGraw Hill Education (India)
2. Engineering Mechanics of Solids, Egor P. Popov, Pearson publication
3. Strength of Materials, R.K.Bansal, Laxmi Publications.

Database Management Systems

Code	Course Title	Credit	T-P-PJ
CUTM1059	Database Management Systems	3	2-1-0

Objective

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database Modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential Properties of DBMS concepts such as: database security, integrity, concurrency
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course outcome

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model,relational database design, relational algebra and SQL
- Design ER-models to represent simple database application scenarios

- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data
- Improve the database design by normalization
- Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing

Course content

Module-1: **DBMS Concepts** **[5 Hrs]**

Data Abstraction - Data models and data independence. Instances and Schemas. Components of a DBMS and overall structure of a DBMS- Life Cycle of a DBMS application- Database terminology.

Module-2: Data Modeling **[5Hrs]**

Basic concepts- Types of data models- Conceptual, physical and logical database models- E-R data model and Object-oriented data model. Components of ER Model- ER Modeling symbols. Entity and entity sets- Relations and relationship sets- E-R Diagrams- Reducing E-R Diagrams into tables.

Practice

Assume we have the following application that models soccer teams, the games they play, and the players in each team. In the design, we want to capture the following:

• We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.

• Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.

• Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.

• For each match we need to keep track of the following:

• The date on which the game is played

• The final result of the match

• The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.

• During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.

• Each match has exactly three referees. For each referee we have an ID (unique identifier),

name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.

Design an ER diagram to capture the above requirements. State any assumptions you have that affects your design (use the back of the page if needed). Make sure cardinalities and primary keys are clear.

Module-3: Relational DBMS Model [5 Hrs]

Basic concepts, Attributes and domains- Intention and extensions of a relation- concept of integrity and referential constraints- Relational Query Languages (Relational algebra and relational calculus (Tuple and domain relational calculus).

Module-4: Relational Database Design [6 Hrs]

Notion of normalized relations- Normalization using Functional Dependency- First Normal form- Second Normal Form- Third Normal form- BCNF.

Practice

Perform NF on the given table

CLICK HERE FOR TABLE

Module-5: SQL [6 Hrs]

Structure of a SQL query- DDL and DML, TCL- SQL queries and sub queries- Tables, views and indexes.

Practice

To study DDL-create and DML-insert commands.

(i) Create tables according to the following definition.

CREATE TABLE DEPOSIT (ACTNO VARCHAR2(5), CNAME VARCHAR2(18), BNAME VARCHAR2(18), AMOUNT NUMBER (8,2), ADATE DATE); CREATE TABLE BRANCH (BNAME VARCHAR2(18), CITY VARCHAR2(18)); CREATE TABLE CUSTOMERS (CNAME VARCHAR2(19), CITY VARCHAR2(18)); CREATE TABLE BORROW(LOANNO VARCHAR2(5), CNAME VARCHAR2(18), BNAME VARCHAR2(18), AMOUNT NUMBER (8,2));

(ii) Insert the data as shown below.

DEPOSIT

CLICK HERE FOR TABLE

BRANCH

CLICK HERE FOR TABLE

CUSTOMERS

CLICK HERE FOR TABLE

BORROW

CLICK HERE FOR TABLE

(1) Describe deposit, branch.

(2) Describe borrow, customers.

(3) List all data from table DEPOSIT.

(4) List all data from table BORROW.

(5) List all data from table CUSTOMERS.

(6) List all data from table BRANCH.

(7) Give account no and amount of depositors.

(8) Give name of depositors having amount greater than 4000.

(9) Give name of customers who opened account after date '1-12-96'.

Module-6: Aggregate functions [4 Hrs]

Set Operations, predicates and joins, Set Membership- Tuple variables- Set comparison- Database modifications using SQL.

Practice

Create the below given table and insert the data accordingly.

Create Table Job (job_id, job_title, min_sal, max_sal)

COLUMN NAME DATA TYPE

job_id Varchar2(15)

job_title Varchar2(30)

min_sal Number(7,2)

max_sal Number(7,2)

Create table Employee (emp_no, emp_name, emp_sal, emp_comm, dept_no)

COLUMN NAME DATA TYPE

emp_no Number(3)

emp_name Varchar2(30)

emp_sal Number(8,2)

emp_comm Number(6,1)

dept_no Number(3)

Create table deposit(a_no,cname,bname,amount,a_date).

COLUMN NAME DATA TYPE

a_no Varchar2(5)

cname Varchar2(15)

bname Varchar2(10)

amount Number(7,2)

a_date Date

Create table borrow(loanno,cname,bname,amount).

COLUMN NAME DATA TYPE

loanno Varchar2(5)

cname Varchar2(15)

bname Varchar2(10)

amount Varchar2(7,2)

Insert following values in the table Employee.

emp_n emp_name emp_sal emp_comm dept _no

101 Smith 800 20

102 Snehal 1600 300 25

103 Adama 1100 0 20

104 Aman 3000 15

105 Anita 5000 50,000 10

106 Sneha 2450 24,500 10

107 Anamika 2975 30

Insert following values in the table job.

CLICK HERE FOR TABLE

Insert following values in the table deposit.

CLICK HERE FOR TABLE

Perform following queries

(1) Retrieve all data from employee, jobs and deposit.

(2) Give details of account no. and deposited rupees of customers having account opened between dates 01-01-06 and 25-07-06.

(3) Display all jobs with minimum salary is greater than 4000.

(4) Display name and salary of employee whose department no is 20. Give alias name to name of employee.

(5) Display employee no,name and department details of those employee whose department lies in(10,20)

To study various options of LIKE predicate

(1) Display all employee whose name start with ‘A’ and third character is ‘ ‘a’.

(2) Display name, number and salary of those employees whose name is 5 characters long and first three characters are ‘Ani’.

(3) Display the non-null values of employees and also employee name second character should be ‘n’ and string should be 5 character long.

(4) Display the null values of employee and also employee name’s third character should be ‘a’.

(5) What will be output if you are giving LIKE predicate as ‘%_%’ ESCAPE ‘\’

To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.

(1) List total deposit from deposit.

(2) List total loan from karolbagh branch

(3) Give maximum loan from branch vrce.

(4) Count total number of customers

(5) Count total number of customer’s cities.

(6) Create table supplier from employee with all the columns.

(7) Create table sup1 from employee with first two columns.

(8) Create table sup2 from employee with no data

(9) Insert the data into sup2 from employee whose second character should be ‘n’ and string should be 5 characters long in employee name field.

(10) Delete all the rows from sup1.

(11) Delete the detail of supplier whose sup_no is 103.

(12) Rename the table sup2.

(13) Destroy table sup1 with all the data.

(14) Update the value dept_no to 10 where second character of emp. name is ‘m’.

(15) Update the value of employee name whose employee number is 103.

To study Single-row functions.

(1) Write a query to display the current date. Label the column Date

(2) For each employee, display the employee number, job, salary, and salary increased by 15% and expressed as a whole number. Label the column New Salary

(3) Modify your query no 4.(2) to add a column that subtracts the old salary from the new salary. Label the column Increase

(4) Write a query that displays the employee's names with the first letter capitalized and all other letters lowercase, and the length of the names, for all employees whose name starts with J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.

(5) Write a query that produces the following for each employee:

earns monthly

(6) Display the name, hire date, number of months employed and day of the week on which the employee has started. Order the results by the day of the week starting with Monday.

(7) Display the hiredate of emp in a format that appears as Seventh of June 1994 12:00:00 AM.

(8) Write a query to calculate the annual compensation of all employees (sal+comm.).

Displaying data from Multiple Tables (join)

(1) Give details of customers ANIL.

(2) Give name of customer who are borrowers and depositors and having living city nagpur

(3) Give city as their city name of customers having same living branch.

(4) Write a query to display the last name, department number, and department name for all employees.

(5) Create a unique listing of all jobs that are in department 30. Include the location of the department in the output

(6) Write a query to display the employee name, department number, and department name for all employees who work in NEW YORK.

(7) Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, respectively.

(8) Create a query to display the name and hire date of any employee hired after employee SCOTT.

Module-7: Transaction Management [8 Hrs]

Subqueries, Manupulating Data, Transaction management and Concurrency control

Practice

To apply the concept of Aggregating Data using Group functions.

(1) List total deposit of customer having account date after 1-jan-96.

(2) List total deposit of customers living in city Nagpur.

(3) List maximum deposit of customers living in bombay.

(4) Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number.

(5) Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE.

(6) Create a query that will display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998

(7) Find the average salaries for each department without displaying the respective department numbers.

(8) Write a query to display the total salary being paid to each job title, within each department.

(9) Find the average salaries > 2000 for each department without displaying the respective department numbers.

(10) Display the job and total salary for each job with a total salary amount exceeding 3000, in which excludes president and sorts the list by the total salary.

(11) List the branches having sum of deposit more than 5000 and located in city bombay.

To solve queries using the concept of sub query.

(1) Write a query to display the last name and hire date of any employee in the same department as SCOTT. Exclude SCOTT

(2) Give name of customers who are depositors having same branch city of mr. sunil.

(3) Give deposit details and loan details of customer in same city where pramod is living.

(4) Create a query to display the employee numbers and last names of all employees who earn more than the average salary. Sort the results in ascending order of salary.

(5) Give names of depositors having same living city as mr. anil and having deposit amount greater than 2000

(6) Display the last name and salary of every employee who reports to ford.

(7) Display the department number, name, and job for every employee in the Accounting department.

(8) List the name of branch having highest number of depositors.

(9) Give the name of cities where in which the maximum numbers of branches are located.

(10) Give name of customers living in same city where maximum depositors are located.

Manipulating Data

(1) Give 10% interest to all depositors.

(2) Give 10% interest to all depositors having branch vrce

(3) Give 10% interest to all depositors living in Nagpur and having branch city Bombay.

(4) Write a query which changes the department number of all employees with empno 7788's job to employee 7844'current department number.

(5) Transfer 10 Rs from account of anil to sunil if both are having same branch.

(6) Give 100 Rs more to all depositors if they are maximum depositors in their respective branch.

(7) Delete depositors of branches having number of customers between 1 to 3.

(8) Delete deposit of vijay.

(9) Delete borrower of branches having average loan less than 1000.

To apply the concept of security and privileges.

To study Transaction control commands

VIRTUAL LAB

TEXT BOOKS

Database Management Systems: Raghu Ramakrishnan

ORACLE PL/SQL Programming – Scott Urman BPB Publications.

REFERENCES

Database Systems Concepts – Henry F Korth, Abraham Silberschatz.

Database Management Systems – Alexis Leon, Mathews Leon – Leon, Vikas Publications

Programming in Java

Code	Course Title	Credit	T-P-PJ
CUTM1058	Programming in Java	3	2-1-0

Objective

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Be aware of the important topics and principles of software development
- Have the ability to write a computer program to solve specified problems
- Have the ability to write a computer program to solve specified problems
- Be able to use the Java SDK environment to create, debug and run simple Java programs

Course outcome

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs
- Read and make elementary modifications to Java programs that solve real-world problems
- Identify and fix defects the common safety issues in code
- Document a Java program using Javadoc
- Use a version control system to track source code in a project
- Qualify confidently any interview process where Java is the requirement

Course content

Module I: Introduction to Java (8 hrs)

Features and Installation, Java Programming Basics, Decision Making and Looping, Class and Object, Inheritance

Practice 1 (1 Hr)

Practice 2 (1 Hr)

Module II: Package and Safe Code (5 Hr)

Interfaces, Packages and Access Protection, Exception Handling (Fault Tolerant Programming)

Practice 3 (1 Hr)

Module III: Collection and Threads (5 Hr)

ArrayList, Vector, Set, Map, Multi-threaded Programming, Synchronization

Practice 4 (1 Hr)

Module IV: Language and Utility Packages (5 Hr)

String Handling, Wrappers, Runtime Memory Management, Cloning, Calendar, Date and Time Facilities, Scanner, Internationalization

Practice 5 (1 Hr)

Practice 6 (1 Hr)

Module V: Input/ Output and Applets (5 Hr)

Byte and Character Stream I/O, Persistence, Applet: Architecture, Skeleton, and Implementation

Practice 7 (1 Hr)

Practice 8 (1 Hr)

Module VI: GUI Programming (5 Hr)

AWT: Container, Components, Layout Managers, Event Handling

Practice 9 (1 Hr)

Practice 10 (1 Hr)

Module VII: Networking and Advanced (5 Hr)

Networking Fundamental, Client-Server Communication, Remote Method Invocation (RMI), Java Virtual Machine (JVM) Tuning, Java Profiler

Practice 11 (1 Hr)

Practice 12 (1 Hr)

Text Book(s):

1. Java The Complete Reference, Fifth Edition, C25 Herbert Schildt, McGraw-Hills

Reference Book(s):

1. Murach's Java Programming, 5th Edition, Joel Murach, Mike Murach & Associates, 2011, ISBN-78-1-943872-07-7

2. Introduction to Java Programming, Comprehensive, 10th ed., Y. Daniel Liang, 2014. ISBN-10: 0133813460, ISBN-13: 9780133813463

https://nqr.gov.in/qualification-title?nid=3002

https://www.cdac.in/index.aspx?id=DAC&courseid=0#

https://canvas.harvard.edu/courses/63117/assignments/syllabus

https://canvas.harvard.edu/courses/69911/assignments/syllabus

https://xid.harvard.edu/xid-apps/submitAccountForm.do

YouTube Resources: freeCodeCamp.org
Codearchery
Edureka
free project
Jenkov

Online Source(s):

1. https://docs.oracle.com/javase/tutorial/java/index.html
2. https://www.programiz.com/java-programming
3. https://marcus-biel.com/

Software/Tool(s): Java 8, Eclipse IDE

Online Compiler: https://ideone.com/

Online Coding Practice: https://www.hackerrank.com/

List of Practices:

Practice 1 (Module-I)

Program-1:

Write a program that computes the standard deviation of a set of floating point numbers that the user enters. First the user says how many numbers N are to follow. Then the program asks for and reads in each floating point number. Finally it writes out the standard deviation. The standard deviation of a set of numbers Xi is:

SD = Math.sqrt(avgSquare - avg2)

Here, avg is the average of the N numbers, and avg2 is its square.

avgSquare is the average of Xi * Xi. In other words, this is the average of the squared value of each floating point number.

For example, if N = 4, say the numbers were:

Xi Xi * Xi

2.0 4.0

3.0 9.0

1.0 1.0

2.0 4.0

sum 8.0 18.0

Now:

avg = 8.0/4 = 2.0

avg2 = 4.0

avgSquare = 18.0/4 = 4.5

SD = Math.sqrt(4.5 - 4.0) = Math.sqrt(.5) = 0.7071067812

To do this you will need to do several things inside the loop body for each floating point value as it comes in: add it to a sum, square it and add it to a sum of squares. Then after the loop is finished apply the formula.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 2 (Module-I)

Program-1:

Better encapsulation of the Goods class would call making instance variables private and using getter and setter methods to access them. A further refinement would be to make the class abstract and to define additional child classes. Here is a revised Goods class:

```
public abstract class GoodsSGA{
private String description;
private double price;
private int quantity;
public GoodsSGA( String des, double pr, int quant )
{description = des;
price = pr;
quantity = quant;}
```

```
double getPrice()
{return price;}
void setPrice( double newPrice)
{price = newPrice;}
int getQuantity()
{return quantity;}
void setQuantity ( int newQuantity )
{quantity = newQuantity;}
public String toString()
{return "item: " + description + " quantity: " + quantity + " price: " + price ;}
```

Revise the source code for the classes Food, Toy, and Book. (Perhaps call the revised classes FoodSG, ToySG, and BookSG.) create a new class ToiletrySG for things like bubble bath. Create a new testing class, StoreSG to test your revised classes.

Note: the child classes will need to use the getter and setter methods to access the instance variables that are declared as private in GoodsSG.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 3 (Module-II)

Program-1:

User-Friendly Division Practice:

Put in a loop so that the user is repeatedly asked for the numerator and the divisor. For each set of data, the program prints out the result, or an informative error message if there is a problem (division by zero or poor input data).

The program continues looping, even if there is a problem Exit the loop when data entered for the numerator start with characters "q" or "Q". Don't print out an error message in this case.

Don't ask for the divisor if the user just asked to quit.

Here is sample output from one run:

```
Enter the numerator: 12
Enter the divisor: 4
12 / 4 is 3
```

Enter the numerator: 12

Enter the divisor : 0

You can't divide 12 by 0

Enter the numerator: glarch

You entered bad data.

Please try again.

Enter the numerator: quit

You will need to use the method charAt() from the String class.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 4 (Module-III)

Program-1:

In mathematics, several operations are defined on sets. The union of two sets A and B is a set that contains all the elements that are in A together with all the elements that are in B. The intersection of A and B is the set that contains elements that are in both A and B. The difference of A and B is the set that contains all the elements of A except for those elements that are also in B.

Suppose that A and B are variables of type set in Java. The mathematical operations on A and B can be computed using methods from the Set interface. In particular:

A.addAll(B) computes the union of A and B; A.retainAll(B) computes the intersection of A and B; and A.removeAll(B) computes the difference of A and B. (These operations change the contents of the set A, while the mathematical operations create a new set without changing A, but that difference is not relevant to this exercise.)

For this exercise, you should write a program that can be used as a "set calculator" for simple operations on sets of non-negative integers. (Negative integers are not allowed.) A set of such integers will be represented as a list of integers, separated by commas and, optionally, spaces and enclosed in square brackets. For example: [1,2,3] or [17, 42, 9, 53,108]. The characters +, *, and - will be used for the union, intersection, and difference operations. The user of the program will type in lines of input containing two sets, separated by an operator. The program should perform the operation and print the resulting set.

Here are some examples:

Input Output

---------- ----------

[1, 2, 3] + [3, 5, 7] [1, 2, 3, 5, 7]

[10,9,8,7] * [2,4,6,8] [8]

[5, 10, 15, 20] - [0, 10, 20] [5, 15]

To represent sets of non-negative integers, use sets of type TreeSet<Integer>. Read the user's input, create two TreeSets, and use the appropriate TreeSet method to perform the requested operation on the two sets. Your program should be able to read and process any number of lines of input. If a line contains a syntax error, your program should not crash. It should report the error and move on to the next line of input. (Note: To print out a Set, A, of Integers, you can just say System.out.println(A). We've chosen the syntax for sets to be the same as that used by the system for outputting a set.)

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 5 (Module-IV)

Program-1:

Password Checker:

Write a program that repeatedly asks the user for a proposed password until the user enters an acceptable password. When the user enters an acceptable password, the program writes a message and exits.

Acceptable passwords:

Are at least 7 characters long.

Contain both upper and lower case alphabetic characters. Contain at least 1 digit. The logic of this program can be quite tricky. Hint: use toUpperCase(), toLowerCase, and equals(). You will also need nested ifs.

Here is a run of the program:

Enter your password:

snowflake

That password is not acceptable.

Enter your password:

SnowFlake

That password is not acceptable.

Enter your password:

snowflake47

That password is not acceptable.

Enter your password:

Snowflake47

Acceptable password.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 6 (Module-IV)

Program-1:

Secret Code:

A text message has been encoded by replacing each character of the message with an integer. Each integer is an index into a key-phrase that contains all the lower case letters of the alphabet as well as the space character. The key-phrase may contain the same character in several locations. The encoded text is series of integers, like this:

35 10 10 33 9 24 3 17 41 8 3 20 51 16 38 44 47 32 33 10 19 38 35 28 49

To decode the message, look up each integer in the key-phrase and output the corresponding character. For example, say that the key-phrase is this (the index of each character has been written above it):

11111111112222222222333333333344444444455

01234567890123456789012345678901234567890123456789012345678901

six perfect quality black jewels amazed the governor

using each integer from the encoded text as an index into the phrase results in the decoded message:

attack the bridge at dawn

Write a program that decodes a secret message contained in a text file. The first line of the text file contains the key-phrase. Then the file contains a sequence of integers, each of which indexes the key-phrase. Find the character corresponding to each integer and output the secret message. Note if

a character character such as 'e' occurs several places in the key-phrase it may be encoded as different integers in different parts of the secret message.

(The recipient of the secret message gets only the file of integers and must put the key-phrase at the top of the file.) For example, here is the contents of a secret message file ready for the program:

six perfect quality black jewels amazed the governor

35 10 10 33 9 24 3 17 41 8 3 20 51 16 38 44 47 32 33 10 19 38 35 28 49

Here is a sample run of the program:

C:\> java Decode < secretFile.txt

attack the bridge at dawn

You will need the charAt() method of String.

Here is another secret message file, with key-phrase inserted, that you can use to test your program:

six perfect quality black jewels amazed the governor

31 16 2 3 4 42 48 7 27 9 10 43 12 13 35 15 1 40 18 3

20 15 33 23 24 32 26 29 28 27 21 31 25 14 34 14 36

42 38 19 40 41 27 3 44 50 46 42 48 49 50 6

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 7 (Module-V)

Program-1:

Stop Word Remover:

Write a program that reads in a file of text, perhaps the text of a novel. The program copies the same text to an output file, except that all the useless words such as "the", "a", and "an" are removed. (Decide on what other words you with to remove. The list of words removed is called a stop list.) Do this by reading the text file token by token using hasNext() and next(), but only writing out tokens not on the stop list.

Prompt the user for the names of the input and output files.

Fairly Easy: The output file will have only N tokens per line. Do this by counting tokens as you output them. N will be something like 10 or 12.

Improved Program: Preserve the line structure of the input file. Do this by reading each line using nextLine() and then creating a new Scanner for that line. (Look at the on-line documentation for Scanner.) With each line's Scanner, use hasNext() and next() to scan through its tokens.
Harder: Write out no more than N characters per line. N will be something like 50. Do this by keeping count of the number of characters written out per line. The length() method of String will be useful. If X characters has already been written to the current line, and if X plus the length of the current token exceeds N, then start a new line.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 8 (Module-V)

Program-1:

E-Mail Address Extractor:

Write a program that scans a text file for possible e-mail addresses. Addresses look like this: someone@somewhere.net

Read tokens from the input file one by one using hasNext() and next(). With the default delimiters of Scanner, an entire e-mail address will be returned as one token. Examine each token using the indexOf() method of String. If a token contains an at sign @ followed some characters later by a period, regard it as a possible e-mail address and write it to the output file.

Programs such as this scan through web pages looking for e-mail addresses that become the targets of spam. Because of this, many web pages contain disguised e-mail addresses that can't easily be automatically extracted.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 9 (Module-VI)

Program-1:

User-friendly Fat Calculator, with Advice:

Further modify the calories from fat calculator so that it includes another TextField that will be set with the text "Too many fat calories" if the percentage of calories from fat is equal or greater than 30 percent, or to "Healthy amount of fat" if the percentage is less than that.

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 10 (Module-VI)

Program-1:

Three Button Monte:

Write a program to implement a game:

There are three buttons in the frame. Two of the buttons cause the program to quit using System.exit(0); the remaining button changes the frame to green (a win!) The winning button is different each time the game is played.

The easy way to do this (although it seems unfair to the user) treats each button the same way. The actionPerformed() method does not check which button was clicked. When any button is clicked, the method picks a random integer from 0 to 2 and performs the "winning" action if the integer happens to be 0. Otherwise, it performs the "losing" action. To the user, it seems like there is a "winning" button and two "losing" buttons. But, in fact, it does not matter which button was clicked.

This is similar to some electronic gambling devices in casinos, where it appears to the user that there are "winning moves" and "losing moves" but in fact the machine actually ignores what the user has done and just declares a "win" every now and then, according to predetermined odds.

You will need the Random class:

```
Random randNum = new Random(); // create a Random number object
int someInt = randNum.nextInt(3); // someInt gets a number from 0 to 2
```

Program-2 and Program-3:

Two suggested competitive programs to solve on HackerRank

https://www.hackerrank.com/domains/java

Practice 11 (Module-VII)

Content Delivery with Networking:

Write a Client-Server program where the client queries with a name of file and the server delivers the content of requested files to the client over the network.

(Improve the program by making the server multi-threaded)

Practice 12 (Module-VII)

Greet the user with Remote Method Invocation:

Write a program using RMI, where the user invokes a method on remote object with username as parameter and receives a greeting message based on time of the day along with username.

Projects

However, not limited to:

1. Chat application
2. Text Editor application
3. GUI based Scientific Calculator
4. Paint application
5. Slam book

(*PROJECT REVIEWS WILL COMMENCE BEYOND CLASS HOURS)

Monitoring:

Credit will be received only on making an honest effort. It is expected that students will finish watching all lecture video and complete all challenge problems by the end of each lecture week.

Borrowing code from other sources is allowed only with proper attribution and credit given to the original author(s).

List of Common Programs to solve using Java:

1.Program to calculate area of a triangle

2.Program to solve quadratic equation

3.Program to swap two zariables (with and without using third variable)

4.Program to generate random numbers in various ways

5.Program to convert miles to kilometers and vice-versa

6.Program to convert celsius to fahrenheit and vice-versa

7.Program to check if a number is odd or even

8.Program to check if input year is leap year

9.Program to test primality

10.Program to print all prime numbers in an interval using "Sieve of Eratosthenes"

11.Program to generate factorial of all elements in an array

12.Program to display the multiplication table up to 20

13.Program to print the fibonacci sequence

14.Program to check armstrong number, perfect number, Harshad number

15.Program to generate armstrong numbers in an Interval

16.Program to find the sum of Harshad numbers in an interval

17.Program to display powers of two Using lambda

18.Program to perform conversions among decimal to binary, octal and hexadecimal

19.Program to display ASCII table

20.Program to find HCF/GCD and LCM

21.Program to find factors of given natural number

22.Program to make a simple calculator

23.Program to shuffle deck of cards

24.Program to generate fibonacci sequence using recursion

25.Program to find sum of natural numbers using recursion

26.Program to find factorial of number using recursion

27.Program to convert decimal to binary using recursion

28.Program to add two matrices

29.Program to obtain transpose of a matrix

30.Program to multiply two matrices

31.Program to check if a string is palindrome

32.Program to remove punctuations from a string

33.Program to sort words lexicographically

34.Program to illustrate different set operations

35.Program to count frequency of each vowel in a string

36.Program to find hash value of a file

Disaster Preparedness & Planning Management

Code	Course Title	Credit	T-P-PJ
CUTM1907	Disaster Preparedness & Planning Management	2	2-0-0

Objective

- To Understand basic concepts in Disaster Management
- To Understand Definitions and Terminologies used in Disaster Management
- To Understand Types and Categories of Disasters
- To Understand the Challenges posed by Disasters
- To understand Impacts of Disasters Key Skills

Course outcome

- 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** (3 Hrs)

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

MODULE 2: DISASTERS (6 Hrs)

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 (3 Hrs)

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) (4 Hrs)

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 (3 Hrs)

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmentally 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

Surveying Techniques

Code	Course Title	Credit	T-P-PJ
CUTM2369	Surveying Techniques	3	1-2-0

Objective

- Apply the knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined surveying problems appropriate to the discipline. To study the temporary adjustment of survey instruments by standard methods.
- Technical Adeptness - Graduates will be technically adept in Surveying Technology as well as supporting math and science disciplines, allowing these graduates to assist professional land surveyors in various surveying and mapping projects. Their technical skills and knowledge will enable them to perform their work duties with a commitment to quality, timeliness, and continuous improvement.
- To do various field works with the help of Modern Instruments e.g. GNSS, Total station and GPR.
- To Carry out topographic survey.

Course outcome

- Understand the basic principles of surveying for vertical, horizontal, linear and angular measurements to arrive at solutions to basic surveying problems.
- Understanding of surveying and using it in field of construction. Further draw contours to represent 3D data on plane figures.
- Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments.
- Design and implement different types of curves for deviating type of alignments, and applying surveying techniques to align highway and railway curves.
- Analyze type of survey operation required for problem solving in field to perform

Course outline:

MODULE-1: INTRODUCTION TO SURVEYING (2 hrs)

Classification and Principles of Surveying, Geodetic and Plane (Topographic) Surveying, Surveying Instruments, Geometry of Ellipsoid: Everest and WGS 84, Latitude and Longitude, Co-ordinate System and Map Projection: Polyconic Projection, Lambert Conformal Conic Projection, Universal Transverse Mercator Projection, Map scale: Fractional or ratio scale, Linear Scale, Graphical Scale.

MODULE-2: BASIC SURVEY OPERATIONS (2Th+6Pr)

Leveling: Concept and principles of levelling, Mean Sea Level, different types of levelling, their application, Source of error in Levelling (instrumental, natural, and personal) and elimination of errors.

Traversing: Traverse angle, Observation of Traverse Length, Selection of Traverse Station, Traverse Field Notes, Angle misclosure, Sources of error in traverse. Balancing angles, Computation of Azimuth or Bearing, Departure and Latitudes, Traverse adjustment, rectangular co-ordinates.

Practice Session:

1. Calculation of RL using HI and Rise and fall method.
2. Traverse by Total Station.

MODULE-3: TOTAL STATION (2Th+4Pr)

Characteristics of Total Station /Electronics Total Station instrument, Function performed by Total Station, Parts of Total Station instrument, Handling and Setting up a Total station, Horizontal angle measurement, Vertical angle measurement, distance and angle measurement, Remote Elevation Measurement (REM), coordinate measurement, to view the data/ points collected, area calculation, data download. Source of error in total station.

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

Practice Session:

4. Distance, angle and slope Measurements
5. Traverse adjustment (With help of software)
6. Area calculation using Total station
7. Height measurement (Remote elevation measurement- REM).
8. Fixing of missing pillars (or) Setting out (or) Stake out.

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

MODULE 4: GLOBAL POSITIONING SYSTEM (2Th+4Pra) Hrs.

Introduction of Global Navigation Satellite System (GNSS): GNSS Satellites: Galileo, NAVSTAR Global Positioning System (GPS), GLONASS and BeiDou Navigation Satellite System. Indian Regional Navigation System, Navigation with Indian Constellation (NivIK), Segments of GNSS/GPS: Control Segment, Space Segments, User Segment-operations of GPS; GPS signals and data; Geo-Positioning-Basic Concepts., accuracy, error sources and analysis, methodology for collection of data, adjustment computations and analysis.

MODULE 5: DIFFERENTIAL GLOBAL POSITIONING SYSTEM (2Th+4Pra) Hrs.

Differential Global Positioning System: Method DGPS/DGNSS, Static and Rapid Static, Kinematic-Real time kinematic Survey, DGPS-GPS data processing and Accuracy, Real Time Kinematic Survey; data down loading and processing. Application of GPS in Surveying and Mapping, Navigation, Military, Location Based Services, Vehicle tracking, etc. Limitation of GPS & DGPS.

MODULE 6: GROUND PENETRATING RADAR (2Th+4Pra) 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.

MODULE 7: CADASTRAL SURVEY (2Th+4Pra) Hrs.

Cadastral map preparation methodology, unique identification number of parcel, position of existing control points and its types, Adjacent boundaries and features, Topology Creation and verification. Scale of Cadastral map, Cadastral Survey by Total Station.

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.

2. Elementary Surveying, by Charles D. Ghilani and Paul R. Wolf Pearson Publication

E Books:

1. Source of reference; NSQF

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

Analysis of Structures

Code	Course Title	Credit	T-P-PJ
CUTM2370	Analysis of Structures	4	2-2-0

Objective

- To introduce the basic concepts and steps for reinforced concrete sectional design mainly in accordance with ultimate strength design.
- To help the student develop an intuitive feeling about structural and material wise behavior and design of reinforced concrete systems and elements.
- To make the students capable of identify and apply the applicable industry design codes relevant to the design of reinforced concrete members.
- To become familiar with professional and contemporary issues in the design and fabrication of reinforced concrete members.

Course outcome

- Understand general mechanical behaviour of reinforced concrete.
- Understand the analysis & design of flexural members.
- Understand the analysis & design of reinforced concrete compression members.
- Understand the analysis & design of vertical and horizontal shear in reinforced concrete.
- Analyse the transfer and development length of concrete reinforcement.
- Understand the analysis & design of types of slabs, footings.
- Get knowledge about basic principle of pre stressed concrete.

Course Syllabus

MODULE-1: INTRODUCTION (4Th+2Pra) Hrs.

Analysis of Indeterminate beams: Determination of internal forces at various sections of the beam by using force method (Consistent deformation method), three moment theorems.

Practices Session:

Determination of Shear force and bending moment, at various sections of the beam subjected to different types of loads using StaaD Analysis software.

Identification of point of contraflexure and point of zero shear.

1. Propped cantilever
2. Continuous beams
3. Fixed beams

MODULE-2: ANALYSIS OF FRAMES (4Th+4Pra) Hrs.

Determination of internal forces at various sections of the portal frames by using displacement method (Slope-deflection method).

Practices Session:

Determination of Shear force and bending moment, at various sections/joints of the portal frame subjected to different types of loads using StaaD Analysis software.

Identification of point of contraflexure and point of zero shear.

1. Rigid jointed portal frame
2. Pin-jointed frame
3. Rigid jointed portal frame with sway

MODULE-3: DEFLECTION IN INDETERMINATE BEAMS (4Th+3Pra) Hrs.

Determination of slope and deflection at various sections of the beam by using moment area method and conjugate beam method.

Practices Session:

Determination of deflections at various sections of the beam subjected to different types of loads using StaaD Analysis software.

1. Propped cantilever
2. Continuous beams
3. Over hanging beams

MODULE-4: DEFLECTION IN RIGID AND PIN JOINTED FRAMES (4Th+3Pra) Hrs.

Determination of slope and deflection at various sections/joints of the pin and rigid jointed frames by using Strain Energy method and unit load method.

Practices Session:

Determination of deflections at various sections of the frame subjected to different types of loads using StaaD Analysis software.

1. Rigid jointed portal frame
2. Pin-jointed frame
3. Rigid jointed portal frame with sway

MODULE-5: STRUCTURAL ANALYSIS USING FLEXIBILITY MATRIX METHOD (4Th+4Pra) Hrs.

Properties of flexibility matrix, Development of flexibility matrix for various cases, Analysis of different types of beams and frames by using Flexibility matrix approach.

Practices Session:

Flexibility coefficients and their use in formulation of compatibility equations using MAT LAB.

1. Continuous beam
2. Propped Cantilever
3. Pin-jointed frame
4. Rigid jointed portal frame

MODULE-6: STRUCTURAL ANALYSIS USING STIFFNESS MATRIX METHOD (6Th+4Pra) Hrs.

Properties of stiffness matrix, Development of stiffness matrix for various cases, Analysis of different types of beams and frames by using stiffness matrix approach.

Practices Session:

Stiffness coefficients for prismatic members and their use for formulation of equilibrium equation using MATLAB including the effect of settlement of supports.

1. Continuous beam
2. Propped Cantilever
3. Pin-jointed frame
4. Rigid jointed portal frame

MODULE-7: ANALYSIS AND CHECK FOR SAFETY (4Th+4Pra) Hrs.

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

Practices Session:

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

2.Story Displacement, Story Drift checks as per code

3.Modal Analysis Case [Eigen or Ritz Vectors], Time period

4.Time History Analysis

Text Books:

1. Matrix method in Structural Analysis, Pandit & Gupta; Tata McGraw Hill, 2008.

2. Structural Mechanics Vol. II, Junnarkar S.B; Charotar Publishers, 2008.

Reference Books:

1. Modern Methods in Structural Analysis, B.N. Thadani & J.P. Desai;Weinall Book Corporation, 1998.

2. Basic Structural Analysis, Reddy C.S; Tata McGraw Hill, 2004.

3. Intermediate Structural analysis, Wang C.K., Tata McGraw Hill. 2010.

4. Structural Analysis, L.S.Negi & R.S. Jangid, Tata McGraw Hill, 2008

5. Structural Analysis Vol. I and II, Gupta & Pandit, Tata McGraw Hill, 2008

6. Analysis of Framed Structure, Gare & Weaver, CBS Publication, 2nd Edition

7. Structural Analysis Volume – I , Devdas Menon, Narosa Publication

8. Structural Analysis Volume – I, Bhavikatti, 3rd edition, Vikas Publishers.

9. Basic Structural Analysis, C S Reddy, Tata McGraw Hill

10. Theory of Structures, Timoshenko & Young, Tata McGraw Hill.

TRANSPORTATION ENGINEERING

Code	Course Title	Credit	T-P-PJ
CUTM2371	Transportation Engineering	3	2-1-0

Objective

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

Course outcome

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

Course Syllabus

MODULE I: INTRODUCTION AND BASIC IN GEOMETRIC DESIGN (3Th+2Pra) Hrs.

Highway planning in India, development, rural and urban roads, road departments in India, road classification, road authorities i.e., IRC, NHAI, CRRI, NHDP etc. Introduction to geometry design: Objective of geometric design, Design speed, cross-section elements, sight distance, horizontal alignment, vertical alignment, Superelevation, camber, cross-section, lane width.

Practice Sessions:

Design of Horizontal Alignment using Civil 3D.

Design of Vertical Alignment using Civil 3D.

Create a profile using Civil 3D.

MODULE II: ROAD MATERIALS CHARACTERISTICS AND CONSTRUCTION (4Th+6Pra) Hrs.

Introduction, Aggregate Characterization: Types of aggregates; Mechanical and shape properties of aggregates, aggregate texture and skid resistance, proportioning and blending of aggregates; Bitumen Characterization; Subgrade Soil Characterization: Properties of subgrade layers; different types of soils, Mechanical response of soil; SPT, DCPT, CPT, CBR. Construction: Plain cement concrete (PCC), Hot Mix Asphalt (HMA), Base/Sub-base layers.

Practice Sessions:

Test on aggregate

Los Angeles abrasion test.

Aggregate crushing test

Aggregate Impact value test

Specific gravity and water absorption

Flakiness index and elongation index test of Aggregate

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

Test on subgrade

California bearing ratio test

MODULE III: PAVEMENT DESIGN (4Th+2Pra) Hrs.

Basis design of Flexible pavements and rigid pavements according to standards.

Practical Sessions:

Marshall Mix design

Plain Concrete Mix design

MODULE IV: TRAFFIC CHARACTERISTICS (3Th+2Pra) Hrs.

Basic traffic characteristics-Speed, volume and concentration, Relationship between Flow, Speed and Concentration Volume Studies- Objectives, Methods; Speed studies- Objectives: Definition of Spot Speed, time mean speed and space mean speed, speed studies, parking study.

Practice Sessions:

Parking study (field study)

Vehicle volume counts (field study)

MODULE V: RAILWAY ENGINEERING AND GEOMETRY (4Th+2Pra) Hrs.

Introduction on component parts of railway track, problems of multi gauge system, coning of wheels, alignments and survey, permanent way track components, Type of rail sections, creep of rails, wear and failure in rails, ballast requirements, sleeper requirements, types of sleepers. Geometric design: Gradients

and grade compensation, various speeds on a railway track, superelevation, horizontal and vertical curves, Points and crossings, signaling and interlocking.

Practical Sessions:

Draw a neat sketch of typical cross section of a permanent way

Environmental resistance test for ballast.

Impurities test on ballast

MODULE VI: AIRPORT PLANNING AND VISUAL AIDS (3Th+2Pra) Hrs.

Airport Master plan, Airport site selection, Air craft characteristics, Zoning laws, Airport classification, Runway orientation, Wind rose diagram, Runway lenth design, Terminal area and Airport layout, Visual aids and Air traffic control. Airport markings and lighting.

Practical Sessions:

Draw a topographical map for Airport Layout by GIS

Draw the typical layout of an airport using AutoCAD.

MODULE VII: HARBOUR & DOCK (1Th+1Pra) Hrs.

Classification of Harbour basin, general layout of harbours, Docks, Different components of docks, Jetties and Dolphins.

Practice Sessions:

Draw layout of harbour using AutoCAD.

Text Books:

1. K.Khanna and C.E.G Justo, Highway engineering.
2. Principles of Transportation Engineering by Partha Chakraborty and Animesh Das
3. R Kadiyali, Traffic engineering and N B Lal, Principles and practice of highway engineering, Khanna Publications, 2005.
4. A text book of railway engineering, By S.C.Saxena and M.G.Arora
5. Air-port Engineering by S.K.Khanna and M.G.Arora

Reference Books:

1. Railway Engineering by Satish Chandra & MM Agrawal, Oxford University Press.
2. Transportation Engineering, Volume-II- Railways, Airports, Docks and Harbours, Bridges and Tunnels by C. venkatramaih, Universities Press.