FACULTYOF ENGINEERING

Scheme of Instructions & Evaluation

(AICTE Model Curriculum for the Academic Years 2020-2024)

and

Syllabi

B. E. V and VI Semesters

of

Four Year Degree Programme

in

Civil Engineering

(Witheffectfromtheacademicyear2020–2021)

(Asapprovedinthefacultymeetingheldonxx-11-2020)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad– 500 007

19.05.2022

For the academic years 2020-2024

SCHEME OF INSTRUCTION& EXAMINATION

B.E. (Civil Engineering) V– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	PC 409 CE	Theory of Structures	3	-	-	30	70	3
2	PC 410 CE	Soil Mechanics	3	-	-	30	70	3
3	PC 411 CE	Concrete Technology	3	-	-	30	70	3
4	PC 412 CE	Water Resources Engineering	3	-	-	30	70	3
5	PC 413 CE	Environmental Engineering	3	-	-	30	70	3
6	PC 414 CE	Construction Engineering & Management	3	-	-	30	70	3
Practical/ Laboratory Courses								
7	PC 455 CE	Soil Mechanics Laboratory	-	-	2	25	50	1
8	PC 456 CE	Concrete Technology Laboratory	-	-	2	25	50	1
9	PC 457 CE	Environmental Engineering Laboratory	-	-	2	25	50	1
10	PW701 CE	Survey Camp	-	-	-			1
			18	**-**	**6**			**22**

For the academic years 2020-2024

THEORY OF STRUCTURES

PC 409 CE

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives

The objectives of this course are to impart knowledge of

1. Analyse thebasic methods of statically indeterminate beams and know the difference between different methods.
2. Analyse the basic methods of statically indeterminate portal frames and know the difference between different methods.
3. Understand the concept of moving loads and ILD for girders and trusses

Course Outcomes

After Completion of this course, the student will be able to

1. Solve statically indeterminate beams and portal frames using Slope Deflection Method
2. Analyse the shear force and bending moment diagrams of statically indeterminate beams and portal frames for different loading condition using Moment distribution method.
3. Analyse the shear force and bending moment diagrams of statically indeterminate beams and portal frames for different loading condition using Kani's method.
4. Analyse Moving Loads and ILD for bending moment and shear force, for determinate girders for different position of loading system and for different sections of girder
5. Analyse Moving Loads and ILD for member forces in determinate Trusses for different position of loading system

UNIT - I

***Slope deflection method*:** Application of the method to continuous beams with and without sinking of supports, single bay - portal frames (Degree of freedom not exceeding three), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

UNIT - II

***Moment distribution method*:** Application of the method to continuous beams with and without sinking of supports, portal frames (static indeterminacy not exceeding three), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

UNIT - III

***Kani's Method*:** Application of the method to continuous beams with and without support sinking, portal frames (static indeterminacy not exceeding three), and loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

UNIT – IV

***Curves of maximum bending moment and shear force*:** for simply supported girders traversed by (l) single point load, (2) two point loads, (3) uniformly distributed-load longer/shorter than span, enveloping parabola and EUDL (4) several point loads not exceeding four.

***Moving loads*:** Influence line for support reaction, bending moment and shear force at any location for simple beams. Determination of maximum bending moment and shear force for moving load systems on simply supported girders.

UNIT – V

***Moving loads on trusses / girders*:** Influence lines for forces in members of statically determinate plane framed structures under moving loads for Warren girder, Pratt truss, and Curved flange truss.

Text Book

1. D.S. Prakash Rao*, "Structural Analysis - A Unified Approach",* University Press,1996.
2. Ramamrutham. S., *"Theory of Structures",* Dhanpath Rai & Sons, New Delhi,2014.

Reference Books

1 Kinney, J. Sterling,*" Indeterminate Structural Analysis*", Oxford Book Company,1999
2 B.C. Punmia, Er.A.K.Jain and Dr.A.K. Jain, *"Theory of structures",* Laxmi Publications, New Delhi,2018.
3 C.S.Reddy, *"Basic Structural Analysis"*, Tata McGraw-Hill Publishing Co. Ltd., 3rd Edition, New Delhi,2010.

SOIL MECHANICS

PC410 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives

1. Introduction of Particulate Mechanics further to the solid and fluidmechanics
2. Characterization and classification of soils based on laboratory and field experiments
3. Understand Seepage, Strength and Compressibility characteristics of soils and learn the analysis of applications involvingthem

Course Outcomes

After Completion of this course, the student will be able to

1. Identify and classify the soil and their index properties.
2. Calculate the capillarity and permeability parameters of soils.
3. Calculate the stresses in the soil and draw to flow net to compute the seepage quantity in soils
4. Describe the mechanisms of the process of compaction and consolidation of soils, and the laboratory procedures to evaluate their characteristics
5. Analyse the soils for their shear strength and predict the stability of slopes.

UNIT - I

Origin & Classification of Soils: Soil as a pseudo-elastic three phase particulate medium Physical Properties of soil: Weight ratios (Water content, Density, Unit weights, Specific Gravity); Volume ratios (void ratio, porosity, degree of saturation, relative density); Interrelationships, Laboratory tests for determination of Index properties. Classification and Identification of soils for general and engineering purposes as per IS: 1498-1970.

UNIT - II

Capillarity in Soils: Surface tension and capillary rise in soil, Capillary tension, Capillary pressure. pF value.

Permeability of Soils: Darcy's law for flow through soils - validity of Darcy's Law - Factors affecting permeability - Laboratory tests for determination of co-efficient of permeability (constant head, variable head permeability tests) - Field tests (Pumping in and pumping out tests) - Equivalent permeability of stratifiedsoils.

UNIT - III

Stress in Soils: Total, effective and neutral stress distribution in different ground conditions

Seepage in Soils: Seepage flow, seepage pressure - Flow nets - Locating phreatic line in a homogeneous earthen dam using Kozeny's parabola - Computation of seepagequantity.

Quick Sand phenomena:Critical Hydraulic gradient, Remedial measures.

UNIT - IV

Compaction Process: Compaction Mechanism; factors affecting compaction.
Laboratory determination of compaction characteristics-standard and modified Proctor tests- IS Light and Heavy compaction tests; compaction equipment, procedure and quality control.

Consolidation Process: Spring analogy - Void ratio and effective stress (e Vs logP) relationship – Terazaghi's theory of one dimensional consolidation - assumptions and derivation of GDE – Computation of magnitude of settlement and time rate of settlement.

UNIT - V

Shear Strength: Significance of Shear strength in soils - Mohr - Coulomb equation - shear parameters - Laboratory tests for determination of shear strength - Direct shear test, Tri-axial compression test, Un-confined compression test, Vane shear test, Factors affecting shear strength of cohesion-less and cohesive soils.

Stability of slopes: Stability of infinite and finite slopes, Swedish circle method, Stability of slopes of earthdams, Taylors Stability number.

Text Books:

1. Punmia , B.C., Ashok Kumar Jain and Arun Kumar Jain *"Soil Mechanics and Foundations"***,**Lakshmi Publication, 17th Edition, 2005.

Reference books:

1. Venkataramaiah, C., *"Geotechnical Engineering",*New Age Publishers,2006
2. Arora, K.R., *"Soil Mechanics and Foundation Engineering"*,Standard Publishers Distributors, revisedand enlarged sixth edition,2007.
3. Murthy, V.N.S., *"Soil Mechanics and Foundation Engineering"*.Dhanpat Rai & Sons,2006

For the academic years 2020-2024

CONCRETE TECHNOLOGY

PC411CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

1. To understand the properties of ingredients of concrete
2. To understand the behavior of fresh and hardened concrete.
3. To understand the different types of admixtures and their uses.
4. To design the concrete mix.
5. To learn different special concretes and their uses.

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Course Outcomes

After Completion of this course, the student will be able to

1. Identify the properties of different ingredients of concrete.
2. Identify the properties of freshand Hardened Concrete.
3. Distinguish different chemical and mineral admixtures as per their applications.
4. Design the concrete mix as per the IS, ACI and British Standard codes.
5. Differentiate special concretes depending on their constituents and specific application.

UNIT – I

***Cement*:** Portland cement- chemical composition- Hydration of cement and hydration products- Structure of hydrate cement- Heat of Hydration and Rate of hydration -Test on physical properties- Different grades of cement- Types of cements.

***Aggregates*:** Classification of aggregate- Particle shape & texture- Bond, Strength & other mechanical properties of aggregate- Specific gravity, Bulk density, Porosity, adsorption & moisture content of aggregate- Bulking of sand- Deleterious Substance of aggregate- Soundness of aggregate- Alkali Aggregate reaction- Thermal properties- Sieve analysis- Fineness modulus- Grading curves- Grading of fine & coarse Aggregates- Gap graded aggregate- Maximum aggregate size.

UNIT – II

***Fresh Concrete*:** Workability- Factors affecting workability- workability tests- Setting times of concrete- Effect of time and temperature on workability- Segregation & bleeding- Mixing and vibration of concrete- Steps in manufacture of concrete- revibration-curing –types of curing - water.

***Admixtures*:** Types of admixtures-mineral and chemical admixtures-properties- dosages- applications and its effect on concrete, water reducing agents.

UNIT – III

***Hardened Concrete*:** Water/Cement ratio- Abram's Law- Gel space ratio- effective water in the mix short term and long term properties of hardened concrete and stress strain curves of concrete,

***Testing of Hardened Concrete*:** Compression tests- Tension tests- Flexure tests - Non-destructive testing methods-Rebound hammer test-ultrasonic pulse velocity test

Elasticity Creep & Shrinkage- Modulus of elasticity- Dynamic modulus of elasticity- Poisson's ratio- Creep of concrete- Factors influencing creep- Relation between creep & time- Nature of

creep- Effects of creep- Shrinkage - types of shrinkage

Durability of concrete – Factors affecting durability– effect of frost concreting in cold weather and hot weather concrete

UNIT – IV

Mix Design**:** Factors in the choice of mix proportions- Durability of concrete- Quality Control of concrete- Statistical Quality control- Acceptance criteria- Proportioning of concrete mix - IS method of mix design – British and ACI method of mix design

UNIT – V

Special Concretes**:** High strength concrete, Ferro cement mass concrete, light weight concrete, high density concrete, polymer concrete selfcompacting concrete,nano concrete recycled aggregate concrete, geopolymer concrete fiber reinforced concrete shotcrete, reactive powder concrete.

Text Books:

1. M.S.Shetty. "*Concrete Technology*" - S.Chand & Co., Revised Edition, 2006.
2. M.L. Gambir "*Concrete Technology*" Tata Mc.Graw Hill Publishers, New Delhi, 5th Edition, 2017.

Reference Books:

1. A.M.Naville "*Properties of Concrete*"Pearson Education India,5th edition, 2012
2. A.R. Santha Kumar "*Concrete Technology*", Oxford university Press New Delhi
3. P.K.Metha and J.M.Monteiro "*Concrete: Micro structure, Properties and Materials*" -, Tata Mc-Graw Hill Education.
4. IS 10262: 2019 "*Concrete Mix Proportioning — Guidelines*" (Second Revision)
5. IS 456 (2000): "*Plain and Reinforced Concrete - Code of Practice"*
6. IS 269:1989 – *Specification for Ordinary Portland Cement*
7. IS 516:1959 *Method of test for Strength of Concrete*
8. IS 2386(Part 1):1963 *Methods of Test for Aggregates for Concrete*: Part 1 Particle Size and Shape
9. IS 2386(Part 2):1963 *Methods of Test for Aggregates for Concrete*: Part 2 Estimation of Deleterious Materials and Organic Impurities
10. IS 2386(Part 3):1963 *Methods of test for Aggregates for Concrete*: Part 3 Specific Gravity, Density, Voids, Absorption and Bulking
11. IS 2386(Part 4):1963 *Methods of test for Aggregates for Concrete*: Part 4 Mechanical Properties
12. IS 2386(Part 5):1963 *Methods of test for Aggregates for Concrete*: Part 5 Soundness
13. IS 2386(Part 6):1963 *Methods of test for Aggregates for Concrete*: Part 6 Measuring Mortar Making Properties of fine Aggregates

For the academic years 2020-2024

WATER RESOURCES ENGINEERING

PE 412 CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Course Objectives:

1. Imparting knowledge regarding the fixation of different levels of reservoirs
2. Description regarding planning and design aspects of different types of Dams
3. Description of design aspects of different types of weirs and regulatory systems
4. Imparting knowledge regarding the different types of cross drainage structures

Course Outcomes:

1. Determine the fixation of different levels of reservoirs
2. Analyze and design gravity dams and earthen dams
3. Explain the design aspects of different types of weirs and regulatory systems.
4. Analyze the different types of cross drainage structures
5. Evaluate the factors leading to the assessment of waterpower potential and layout of a hydel plant

UNIT – I

Storage works: Purpose, selection of site, zones of storage, computation of storage capacity, fixation of different levels of reservoirs (L WL, FRL, MWL), evaporation reduction techniques.

Dams: Classification of dams, selection of site for a dam, physical factors governing the selection of types of a dam.

UNIT – II

Gravity dams:

Forces acting on gravity dam, failures of gravity dam, Stability of gravity dams, principal and shear stresses, elementary and practical profiles of a gravity dam, economical height of dam, high and low gravity dams, functions, and types of galleries in gravity dams

UNIT – III

Earthen Dams:

Types, methods of construction, failures of earth dam, Criteria for the safe design of an earth dam, computation of seepage from flow net, phreatic line in an earth dam (for homogeneous sections with and without filter cases), design of earth dams to suit available materials, embankment and foundation seepage control measures.

UNIT – IV

Tank Irrigation: Types, site selection, causes of failure of tanks weirs, design of tank weirs, general specifications for construction of tank weirs

Spill ways: Different Types of Spill ways, energy dissipation below spillways, different types of spillway crest gates, stilting basin appurtenances

UNIT – V

Water power Engineering: Demand and generation ,different heads, load factor, capacity factor and utilization factor, Assessment of water power potential, primary and secondary power, components and types of hydel plants, penstocks and surge tanks, power house layout, components and their functions.

Text Books:

1) Punmia, B.C., Pande B. B., *"Irrigation and Water Power Engineering"*, Standard Book House, New Delhi,17th Edition, 2021.
2) Garg, S.K., *'Irrigation and Hydraulic Structures'*,Khanna Publishers, NewDelhi,1993.

Reference Books

1) Modi P.N., *'Irrigation and Water Resources and Water Power Engineering'*, Standard Book House, New Delhi,2019
2) S. K. Sharma "*Irrigation Engineering & Hydraulic Structures*"S. Chand Publishers, New Delhi2016.
3) N. N. Basak, *"Irrigation Engineering"*, Mcgraw Higher Education,1999.

For the academic years 2020-2024

ENVIRONMENTAL ENGINEERING

PC 413CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Course Objectives:

1. Fill the gap between general introductory environmental science and the more advanced environmental engineering
2. Explain the different sequential unit operations of water and wastewater treatment processes
3. Provide necessary engineering principles for analyzing the environmental issues
4. Motivate the present and future generations to take suitable care of sustainability of all existing resources

Course Outcomes:

After Completion of this course, the student will be able to

1. Predict water demands for water supply in the societal context
2. Design environmental engineering systems including the considerations of risk and environmental impacts
3. Characterize sewage systems and design sewers and appurtenances
4. Design sludge disposal systems and septic tanks
5. Categorize air and noise pollution impacts and standards

UNIT – I

Water Supply: Need for planned water supply schemes, water demand for industrial and agricultural water requirements, sources of water, water quality requirements for different beneficial uses, population forecast, water treatment through aeration, coagulation flocculation, and sedimentation.

UNIT – II

Water Treatment: Filtration, Disinfection, and Softening, methods of layout of distribution pipes, design of distribution by Hardy Cross method for simple networks, various types of pipes and valves used in water supply systems.

UNIT – III

Sewage: Domestic and storm water, Quantity of Sewage, Sewage flow variations.
Conveyance of sewage: Sewers shapes, design of sewerage systems, operation and maintenance of sewers, sewage pumping, sewer appurtenances

UNIT – IV

River cleaning plans: Self-purification of streams, BOD and COD concepts, wastewater treatment, aerobic and anaerobic treatment system, suspended and attached growth systems, quality requirements of recycled water for various purposes. Principles of Septic Tank

UNIT – V

Advanced WWT concepts: Theory and design concepts of Activated Sludge process, Mechanically Aerated Lagoons, Sequencing Batch Reactor (SBR), waste stabilization ponds, basic concepts of bio-remediation**.**

Text Books:

1. Fair. G. M. and Geyer. J. C. *"Water and Wastewater Engineering"*,Vol. I and II, John Wiley &Sons Inc., New York, 2010.
2. White. J.B. *"Wastewater Engineering"*, Edward Arnold. London, 1978

Reference Books:

1. Hammer. M. J. and Hammer. M. J. Jr., *"Water and Wastewater Technology"*, Prentice-Hall of India Pvt. Ltd., New Delhi, 1998
2. Metcalf & Eddy. *"Wastewater Engg; Treatment, Disposal Reuse"*, Tata McGraw- Hill Publishing Company Limited, New Delhi,1995
3. Sasi Kumar, K & Sanoop Gopi Krishna., *"Solid Waste Management"*, PHI Publishers, 2013
4. Gilbert, M. Masters, "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., New Delhi, 1995

CONSTRUCTION ENGINEERING AND MANAGEMENT

PC 414 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Understand the techniques involved in construction project management and practices.
2. Introduce with the concepts of construction planning and scheduling techniques
3. Acquaint with the concepts and application of optimization in construction monitoring and control

Course Outcomes:

After Completion of this course, the student will be able to

1. Apply construction practices and management systems to construction projects
2. Apply various resource management techniques in construction projects
3. Apply project management software for resource optimization in construction projects
4. Prepare the contract acts and tender documentation
5. Apply optimization techniques in monitoring and control of construction projects

UNIT – I

Introduction*:* Introduction to Construction Industry - Significance, objectives and functions, stakeholders, roles, responsibilities and functional relationships, Construction projects – objectives and lifecycle, existing construction practices and project management systems, Project scale, Economy of scale application in construction cost estimates.

UNIT – II

Construction Management through Network Theory: Definitions and different types of Event, activity, dummy, Network rules, Network event numbering (Fulkerson Rule), Hierarchies of complex network, work break down structure, Liner Scheduling methods - bar charts, milestone charts, LOB, their limitations, difference between PERT and CPM, network based scheduling techniques - PERT, CPM, AON and AOA in construction management. Numerical Problems.

UNIT – III

Cost & Resource Optimization Techniques: Cost Model - Direct and Indirect Cost component of Project, Cost Slope, Project Cost-Time analysis and optimization. Resource usage profile, Histograms, Resource allocation, smoothing & levelling techniques. Project Updating. Introduction of Project management software - Building Information Modelling (BIM), etc

UNIT – IV

Contracts: Introduction, types of construction contracts and their advantages and disadvantages, condition of contracts, safety, health and environment on project sites, accidents their causes, effects and preventive measures, costs of accidents, workmen compensation act, contract labor act.

Tender: Tender form, tender documents, notice inviting tenders, Work order.

Project Delivery Methods: BOT, SBOO. BOOT, Public Private Partnership (PPP), Detailed project report (DPR)

UNIT – V

***Linear programming and optimization in construction*:** Introduction to optimization – Linear programming, Importance of optimization in construction, Simple problems on formulation of LP, Graphical method, Simplex method, Big M-Method,Case studies

Text Books:

1. Srinath L.S., *"PERT and CPM: Principles and Application"*, East-West Press, 2001.
2. Seetharaman S., *"Construction Engineering and Management"*, Umesh Publications, 2012.

Reference Books:

1. Gahloj. P.S. and Dhiv. B.M., *"Construction Planning and Management"*, Wiley Eastern Ltd., 2018.
2. Punmia, B. C., and Khandelwal, K. K., "*Project planning and control with PERT and CPM"*, 2006.
3. Chitkara, K. K. *"Construction Project Management: Planning, Scheduling and Controlling"*. Tata McGraw–Hill Education, 2004.

SOIL MECHANICS LABORATORY

PC 455 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Course Objectives:

1. Expose the students to different types of soils
2. Experience the concepts of soil mass, soil solids, and soil structure.
3. Understand the laboratory test procedures and appreciate the suitability of each test.
4. Make the students to relate theoretical concepts in doing lab tests

Course Outcomes:

After Completion of this course, the student will be able to

1. Analyse thesoil test results, interpret and validate thesame
2. Describe the soil behavior and hence enhanced understanding ofsoil mechanics
3. Demonstrate the fieldapplication in the laboratory to take upresearch
4. Analyse the shear parameters in calculation of Bearing capacity of soils

LIST OF EXPERIMENTS

DETERMINATION OF INDEX PROPERTIES:

1a) Determination of Specific Gravity of soil solids using Density bottle method
1b) Determination of Specific Gravity of Soil Solids using Pycnometer method
2) Determination of water content using Pycnometer method
3a) Determination of Liquid limit using Casagrande's standard Liquid Limitdevice
3b) Determination of Liquid limit using Cone Penetration apparatus
3c) Determination of Plastic limit and Shrinkage limit
4) Sieve Analysis for plotting Particle size distribution curve.
5) Determination of Field Density using Sand Replacement Method

DETERMINA TION OF ENGINEERING PROPERTIES:

6) Determination of Compaction Characteristics
7a) Determination of Co-efficient of Permeability by Constant Head Permeameter test
7b) Determination of Co-efficient of Permeability by Variable Head Permeameter test
8a) Determination of shear strength, parameters by Direct Shear Test
8b) Determination of shear strength Cohesive soils by Unconfined Compression test
8c) Determination of shear strength by conducting Vane Shear Test

DEMONSTRATION OF TEST PROCEDURE:

9) Consolidometer test
10) Tri-axial compression Test
11) Laboratory Plate Load Test
12) Reverse Osmosis Test
13) Quick Sand Model
14) Cyclic Tri-axial Test Facility

Note: *At least ten experiments should be conducted in the Semester*

Reference Books:

1. Lambe, T.W., *"Soil Testing for Engineers"*,Wiley Eastern Ltd., New Delhi, 1969.
2. S.Mittal, *"Soil Testing for Engineers",* Khanna Publishers, 1992.

CONCRETE TECHNOLOGY LABORATORY

PC 456 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Course Objectives:

1. Determine behavior of materials through physical tests.
2. Infer suitability of materials in construction.
3. Able to prepare concrete as per the standards.

Course Outcomes: At the end of the semester student should be able to

1. Assess the suitability of different ingredients of concrete by conducting various test prescribed by relevant IS codes.
2. Assess the workability of concrete and recommend its suitability for structural works.
3. Determine the strengths of hardened concrete in compression, flexure and split tensile tests.

I. Test on Cement

1. Normal Consistency and fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity of cement
4. Soundness of cement.
5. Compressive strength of cement.

II. Test on Aggregate

1. Sieve Analysis and grading of aggregates
2. Specific gravity of aggregates
3. Bulking of sand.
4. Bulk and compact densities of fine and coarse aggregates

III. Test on Fresh & Hardened Concrete

1. Slump Cone test
2. Compaction Factor Test
3. Compressive strength of concrete
4. Split tensile strength of concrete
5. Flexural strength of concrete

Reference Books

1. A.R.Shanthakumar "*Concrete Technology*"– Oxford Publishers (Second edition)
2. M.S.Shetty and A.K.Jain "*Concrete Technology*"- S.Chand& Co, 2018.
3. M.L. Gambhir "*Concrete Manual*", Dhanpat Rai & Sons
4. IS 10262: 2019 "*Concrete Mix Proportioning — Guidelines*" (Second Revision)
5. IS 456 (2000): "*Plain and Reinforced Concrete - Code of Practice"*
6. IS 269:1989 – *Specification for Ordinary Portland Cement*
7. IS 516:1959 *Method of test for Strength of Concrete*
8. IS 2386(Part 1):1963 *Methods of test for Aggregates for Concrete*: Part 1 Particle Size and Shape
9. IS 2386(Part 2):1963 *Methods of test for Aggregates for Concrete*: Part 2 Estimation of Deleterious Materials and Organic Impurities

10. IS 2386(Part 3):1963 *Methods of test for Aggregates for Concrete*: Part 3 Specific Gravity, Density, Voids, Absorption and Bulking

11. IS 2386(Part 4):1963 *Methods of test for Aggregates for Concrete*: Part 4 Mechanical Properties

12. IS 2386(Part 5):1963 *Methods of test for Aggregates for Concrete*: Part 5 Soundness

13. IS 2386(Part 6):1963 *Methods of test for Aggregates for Concrete*: Part 6 Measuring Mortar Making Properties of fine Aggregates.

For the academic years 2020-2024

ENVIRONMENTAL ENGINEERING LAB

PC 457 CE

Instruction:2periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits :1

Objectives:

1. Characterization of water and wastewater to ensure security and well-being of humanity
2. Verify the efficiency of certain water treatment processes
3. Understand the importance of coagulation

Outcomes:

After Completion of this course, the student will be able to

1. Compile and use of experimental information
2. Conduct experiments on water sample for physical and chemical tests
3. Analyze and interpret data and present results on water samples

List of Experiments

1. a) Determination of total dissolved solids
   b)Determination of total suspended solids
   c)Determination of fluorides
2. Determination of pH and EC
3. Determination of total hardness
4. Determination of alkalinity
5. Determination of chlorides
6. Determination of residual chlorine
7. Determination of Dissolved oxygen(D.O)
8. Determination of residual chlorine
9. Determination of optimum alum dosage
10. Determination of BOD
11. Determination of COD
12. Determination of turbidity in water sample using nephelo turbidity meter

Reference Books:

1 Fair. G.M. and Geyer. J.C. *"Water and Wastewater Engineering",*Vol. I & II. John Wiley & Sons Inc., New York, 2010.

2 White. J.B**.** "*Wastewater Engineering",* 2nd Edition, Edward Arnold. London, 1978

3 Hammer. M.J. and Hammer. M.J. Jr., *"Water and Wastewater Technology",*Prentice-Hall of India Pvt.Ltd., New Delhi, 1998.

SURVEY CAMP

PW 701 CE

Credits : 1

Course Objectives:

1.Field exercises with modern surveying equipments like Total station
2.All aspects of executing and plotting of field surveys
3.Work in team and make effective presentations

Course Outcomes:

After completing this course, the student will be able to:

1. Apply surveying knowledge and tools effectively for projects
2. Develop knowledge of practical application of different survey works .
3. Develop their leadership qualities as well as ability to work in teams.
4. Create a report on topics based on work done during the survey camp

Course Content:

A one-week (6days, 36 hours) surveying camp should be organised in the intervening period of IV semester and the commencement of V semester. The work has to be graded for 1 credit by a committee consisting of the Head of the department and 2-3 senior faculty members. The surveying camp should expose the students to all the aspects of planning, organising and conducting a field survey and plotting of the same.

For the academic years 2020-2024

SCHEME OF INSTRUCTION& EXAMINATION

B.E. (Civil Engineering) VI– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	HS 104 BM	Professional Practice & Ethics	2	-	-	30	70	2
2	PC 415 CE	Design of Steel Structures	3	-	-	30	70	3
3	PC 416 CE	Transportation Engineering	3	-	-	30	70	3
4	PE-1	Professional Elective – I	3	-	-	30	70	3
5	PE-2	Professional Elective - II	3	-	-	30	70	3
6	PE-3	Professional Elective - III	3	-	-	30	70	3
7	OE-I	Open Elective – I	3	-	-	30	70	3
Practical/ Laboratory Courses								
8	PC 458 CE	Transportation Engineering Laboratory	-	-	2	25	50	1
9	PC 459 CE	Computer Applications Laboratory	-	-	2	25	50	1
		Summer Internship*						
			18	**-**	**6**			**22**

* To be conducted after the VI Semester in the Summer Vacation and to be evaluated in VII Sem

Professional Elective – 1		
S. No.	**Course Code**	**Course Title**
1	PE 501 CE	Structural Analysis
2	PE 502 CE	Geotechnical Design
3	PE 503 CE	Open Channel Flows
4	PE 504 CE	Construction Equipment and Automation

Professional Elective – 2		
S. No.	**Course Code**	**Course Title**
1	PE 505 CE	Earthquake Resistant Design of Structures
2	PE 506 CE	Foundation Engineering
3	PE 507 CE	Ground Water Engineering
4	PE 508 CE	Sustainable Construction Methods

Professional Elective – 3		
S. No.	**Course Code**	**Course Title**
1	PE 509 CE	Advanced ConcreteTechnology
2	PE 510 CE	Road Safety Engineering
3	PE 511 CE	Design of Irrigation Structures
4	PE 512 CE	Infrastructure Engineering

Open Elective 1		
Sl.No	**Code**	**Name of Subject**
1	**OE601 EE**	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
2	**OE602 EE**	Reliability Engineering (Not for EEE & EIE Students)
3	**OE611 AE**	Basics of Automobile Engineering(Not for Mech./Prod./Automobile Engg. students)
4	**OE611 ME**	Industrial Robotics (Not for Mech./Prod./Automobile Engg. students)
5	**OE601 EG**	Soft Skills & Interpersonal Skills
6	**OE602 MB**	Human Resource Development and Organizational Behaviour
7	**OE601 LW**	Cyber Law and Ethics
8	**OE601 CS**	Operating Systems (Not for CSE Students)
9	**OE602 CS**	OOP using Java (Not for CSE Students)
10	**OE601 IT**	Database Systems (Not for IT Students)
11	**OE602 IT**	Data Structures (Not for IT Students)
12	**OE601 CE**	Disaster Mitigation (Not for Civil Engg. Students)

PROFESSIONAL PRACTICE & ETHICS

HS 104 BM

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 2

Course Objectives:

1. To impart understanding of the stakeholders, their roles and regulatory bodies in professional practice.
2. To impart understanding of professional ethics and the code of ethics.
3. To impart understanding of Arbitration, Conciliation and Alternative Dispute Resolutionsystems
4. To impart understanding of the labour laws and Engagements
5. To impart understanding of laws related to patents and intellectual property rights

Course Outcomes:

After Completion of this course, the student will be able to

1. Identify professional practice, introduction of variousstakeholders and their respectiveroles, understanding the fundamental ethics governing the profession
2. Summarize contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour.
3. Describe the Intellectual Property Rights and patents.
4. Differentiate the types of roles they are expected to play in the society as practitioners of the civil engineering profession
5. Demonstrate good ideas of the legal and practical aspects of their profession

Unit 1

Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)

Unit 2

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

Unit 3

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Unit 4

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

Unit 5

Law relating to Intellectual property: Introduction – meaning of intellectual property,
main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

Text Books:

1. B.S. Patil, "*Legal Aspects of Building and Engineering Contracts*", CRC Press, 7th Edition, 2020.
2. BIS "*The National Building Code*", 2017
3. RERA Act, 2017

Reference Books:

1 Meena Rao (2006), "*Fundamental Concepts in Law of Contract*", 3rd Edn. Professional Offset
2 Neelima Chandiramani (2000), "The *Law of Contract: An Outline*", 2nd Edn. Avinash PublicationsMumbai
3 Avtarsingh (2002), "*Law of Contract"*, Eastern Book Co.

For the academic years 2020-2024

DESIGN OF STEEL STRUCTURES

PC415CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Know the IS code provisions as applicable for the designs.
2. Introduce the students to the different philosophies for steel structures and the basic steps in the design process
3. Introduce the students to the design of main steel members of a steel structure and connections

Course Outcomes:

After completion of the course the student will be able to:

1. Design Bolted and Welded Connection, both simple and eccentric.
2. Design the Tension members.
3. Design the Flexural member.
4. Design a column and column base.
5. Analyse and design a roof truss for Gravity loads and wind loads.

UNIT – I

Materials and Specifications: Chemical composition of steel, types of Structural Steel, Residual stresses, Stress Concentration.

Basis of Structural Design: Codes and Specifications, Design Philosophies, working Stress Method, Limit State Method.

Loading and Load Combinations: Characteristic Loads, Dead Loads, Imposed Loads, Earthquake Loads, Wind Loads and Load Combinations. Partial safety factors for materials and loads.

Bolted Connections (Limit state method):Bolted Connections, Behavior of Bolted Joints, Design Strength of Ordinary Black Bolts, Design Strength of High Strength Friction Grip Bolts, Pin Connections, Simple Connections and Eccentric Connections.

Welded Connections (Limit State Method): Advantages of Welding, Types of Welds and Joints, Simple Connections and Eccentric Connections.

UNIT – II

Design of Tension Members (Limit State Method): Types of Tension Members, Design of Strands, Slenderness Ratio, Modes of Failure, Factors Effecting Strength of Tension Members, Design of Tension Members (Angles, Other sections and Rods), Lug Angles, Tension Member Splice.

UNIT – III

Design of Beams (Limit State Method):Types of Beams, Section Classification, Lateral Stability of Beams, Buckling of Real Beams, Behavior of Beams in Bending, Design of Laterally Supported and Unsupported Beams, Design of Compound Beams, Shear Strength of Beams, Maximum Deflection, Web Buckling and Web Crippling,

Crane and Gantry girders: Basic Principles, Limit state design of single bay portal with crane including detailing.

UNIT – IV

Design of Compression Members (Limit State Method): Introduction, Possible Failure Modes, Behavior of Compression Members, Elastic Buckling of Slender Compression Members, Behavior of Real Compression Members, Sections of Compression Members, Effective Length, Design of Compression Members with Single Section and Built-up Sections (Symmetric in both directions), Lacing and Battening, Column Splices. Design of Column Bases (Limit state method): Design of Slab Base and Gusseted Base for Column

UNIT – V

***Design of Roof Trusses (Limit State Method*):** Types of Trusses, End Bearings, Spacing of Trusses and Purlins, Estimation of Loads with different Roof Coverings, Self-weight of Truss, Wind Effects, Design of Purlins for Dead Load, Imposed Load and Wind Loads. Detailed Design of Roof Trusses including Joints and Supports (only Angular Trusses)

Text Books:

1. Subramanian. N, "*Design of Steel Structures"*, Oxford University Press, 2010.
2. Duggal S.K., "*Design of Steel Structures"*, 3rd Edition, Tata McGraw Hill Publishing, 2017.

Reference Books:

1. Bhavikatti, S.S., "*Design of Steel Structures"*, 5th Edition, I.K. International Publishing House Pvt. Ltd. 2017.
2. P. Dayaratnam, "*Design of Steel Structures"*, S. Chand & Co. New Delhi, 2012.
3. IS- 800-2007 "*General Construction in steel - Code of Practice*" Bureau of Indian Standards,New Delhi, India
4. SP 06- (1) -1964 – *" Hand Book for Structural Engineers"* Bureau of Indian Standards,New Delhi, India

For the academic years 2020-2024

TRANSPORTATION ENGINEERING

PC416 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

The objectives of this course is to impart knowledge of

1. The need of highways and its classification as per IRC codes
2. Design the highway geometrics as per the standard code of practice
3. Study various traffic studies including analysis and design
4. Study various aspects of Railway Engineering
5. Study airport engineering concepts and designs

Course Outcomes:

After completing this course, the student will be able to:

1) Identify basic elements of highway alignment and design of highway geometrics
2) Carry out traffic studies and implement traffic regulation and control measures.
3) Characterize pavement materials, design flexible & rigid pavements as per IRC
4) Explain various elements of railway engineering and design various elements
5) Explain the basic operations of airport engineering and design of runways

UNIT – I

Highway Development and Planning: Highway development in India, Classification of Roads as per IRC, present status of Highway infrastructure in India, National Transport Policy, Role of IRC, CRRI and NHDP. Highway alignment, importance of Engineering Surveys for highway alignment.

Geometric Design of Highways - Cross sectional elements - camber, concept of sight distances stopping sight distance and overtaking sight distance.

Design of Horizontal alignment- concept of centrifugal force, superelevation, extra widening and transition curves.

Design of Vertical alignment- gradient, grade compensation, summit and valley curves.

UNIT – II

Traffic Engineering: Traffic characteristics, volume, speed, density, headways and relationship among them. highway capacity and level of service concept, mobility and accessibility concepts, Traffic volume studies,speed studies, speed and delay studies, Origin &Destination studies. Types of intersections, rotary, channelization, pedestrian facilities, parking studies, design oftraffic signals by Webster and IRC method.

UNIT – III

Pavement Material Characterization: Pavement materials: Materials used in Highway Construction- Desirable properties of road aggregates and tests. CBR test, types of paving binders – Paving grade bitumen, modified bituminous binders, cut-back bitumen, andBitumen emulsion, Tests on Bitumen, Grading of bitumen, Bituminous paving mixes.

Pavement Design: Types of pavements, factors to be considered for pavement design, Design of Flexible pavement & Rigid pavement design as per relevant IRC codes, Analysis of stresses in rigid pavements-Westergaard's wheel load stress equations. temperature, frictional and warping stresses. Introduction to construction joints, expansion joints, contraction joints for jointed plain cement concrete pavements. Functions of dowel and tie bars.

UNIT – IV

Railway Engineering: History of Indian Railways, Different types of gauges, Permanent way component parts and its functions. Rails – various types and functions, creep of rails, creep measurement, coning of wheels, Track fittings and fastenings, Sleepers- various types and functions, merits and demerits, ballast, various types and functions and sub grade preparation. Geometric design of railway track, points and crossings, signals and interlocking, station yards planning.

UNIT – V

Airport Engineering: History of Air Transportation, ICAO guidelines,understanding of aircraft types & configurations, Airport planning, airport site selection and regional development, components of airport and its functions including terminal building, runway orientation by wind rose diagram, runway and taxi way geometric design, Air traffic forecasting methods. Types of landing and take-off and its soft and hard infrastructure including Radar, GIS and GPS technology.

Text Books:

1. Khanna,.S.K., Justo.C.E.G., Veeraraghavan. A., "*Highway Engineering*", 10th Edition, Nem Chand & Bros, 2015.
2. Satish Chandra, Agarwal.M.M., "*Railway Engineering*" Second Edition, Oxford University Press, 2013.
3. Khanna,.S.K., Arora.M.G., Jain.S.S., "*Airport Planning and Design*" 6 Edition, Nem Chand,1999.

Reference Books:

1. Kadiyali.L.R,"*Traffic Engineering and Transportation Planning***"**, KhannaPublishers,2016
2. ITE Hand Book, "*Highway Engineering Hand Book"*, McGraw - Hill.
3. SrinivasaKumar.R., "*Pavement Design*", Orient Blackswan Pvt. Ltd., New Delhi, 2013

4. SrinivasaKumar.R., "*Transportation Engineering" (Railways, Airport, Docks Harbour*), Universities Press, 2014.

For the academic years 2020-2024

TRANSPORTATION ENGINEERING LABORATORY

PC 458 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Course Objectives:

1. Know the properties of various road materials
2. Create the awareness about various traffic studies in the field

Course Outcomes:

After completing this course, the student will be able to:

1. Characterize the pavement materials.
2. Perform quality control tests on pavement material and pavements.
3. Conduct traffic studies for estimation of traffic flow characteristics.

List of Experiments:

A) Tests on Bitumen

1. Penetration Test.
2. Ductility Test
3. Softening point test
4. Specific gravity test
5. Viscosity test
6. Flash and fire point test

B) Tests on Road Aggregate

7. Aggregate crushing value test
8. Los Angeles abrasion test
9. Aggregate impact value test
10. Aggregate shape test (flakiness & elongation)
11. Specific gravity
12. Water Absorption
13. Soundness

C) Experiments on Traffic

14. Traffic Volume study (a) at mid-section (b) at intersection
15. Spot speed study
16. Speed and delay study
17. Origin and Destination Study

D) Miscellaneous Tests (Demonstration Only)

18. Marshall stability test
19. Determination of C.B.R.
20. Benkelman beam test
21. Bitumen extraction test
22. Exposure to Latest Software in the field of Transportation Engineering

Note: At least ten experiments should be conducted in the Semester

Reference Manual:

1. Khanna, S. K. and Justo, C.E.G., *"Highway Material Testing (laboratory manual)"*. Nem Chand & Bros, Roorkee (2000)

Reference Codes:

1. Relevant IS and IRC Codes of Practice.
2. Relevant ASTM and AASHTO Codes of Practice

COMPUTER APPLICATIONS LABORATORY

PC 459 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Course Objectives:

1. To understand the application of software in Civil Engineering
2. To Analyze and Design of structural members using Excel
3. To Use software knowledge for solving fluid mechanics &geotechnical related problems
4. To introduce the civil engineering-based software Staad pro

Course Outcomes:

1. Use software skills to solve civil engineering related analysis and design.
2. Analyse and design of RCC beam using limit state design.
3. Analyse and solve problems related to hydraulic structures using software
4. Compute bearing capacity and other geotechnical related problems using software.
5. UseCivil Engineering software STAAD PRO for analysis and design of basic elements of structure

List of Experiments to be performed:

1. Computation of discharge over a rectangular notch using velocity of approach
2. Calculation of normal depth in a trapezoidal channel
3. Calculation of critical depth in a trapezoidal channel
4. Calculation of Φ-index
5. Estimation of specific capacity and maximum pumping rate of a well
6. Analysis of pipe network in water distribution systems
7. Flood routing using Muskigham's method
8. Design of an irrigation channel using Kennedy's theory by 3 approaches
9. Design of trapezoidal notch canal fall
10. Selection of optimal pipe diameter for turbulent flow
11. Design of circular sewer
12. Structural design of an RCC beam section using limit state method, given Grade of concrete, Grade of steel, BM and SF.
13. A rectangular cross section is subjected to a non-central force parallel to axis of member. Determine the direct and bending stresses at any location of the section
14. Analysis and design of a flexural member using STAAD Pro
15. Analysis and design of a simple RCC frame one-bay two storey using STAAD Pro
16. Analysis and design of a simple steel truss using STAAD Pro
17. Determination of pressure bulb underneath a footing using Boussinesq’s equation
18. Compute bearing capacity of a shallow foundation as per IS: 6403 -1980
19. Compute the consolidation settlement duly dividing the strata in to infinitesimally small layers to fulfil the Terzaghi‘s assumption.

Reference Books/ Manuals:

1. STAAD package manual.
2. Excel Package Manual.
3. Ritesh Kumar "*Advanced Excel-2016*". Gyan Vandana Publications.

PROFESSIONAL ELECTIVES - I

STRUCTURAL ANALYSIS

PE501CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives

The objectives of this course is to impart knowledge of:

1. Analysis of Arches and suspension bridges for static loads & moving loads using influence lines
2. Illustrate the matrix methods of structural analysis for computer applications.
3. Analysis of indeterminate structures by different methods

Course Outcomes

After completing this course, the student will be able to:

1. Analyse the Arches, cables and suspension bridges for static & moving loads
2. Analyse the structure using flexibility matrix method to calculate the Redundant forces and sketch the BMD and SFD
3. Analyse the structure using Stiffness matrix method to calculate the Redundant forces and sketch the BMD and SFD
4. Develop Stiffness matrix using Direct Element method for indeterminate structures
5. Analyse the frames using approximate methods of Analysis

UNIT – I

***Elastic Theory of Arches*:** Eddy's theorem, three hinged parabolic and segmental arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading , Influence linesfor horizontal thrust, bending moment, normal thrust and radial shear for three hinged arches.

Two hinged arches: parabolic and segmental, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading.

Cables and Suspension bridges: Stresses in suspended loaded cables, length of cable, simple suspension bridge with 3-hinged stiffening girders for static load, Influence lines for horizontal and vertical components of tension in the cable, tension in the cable, bending moment and shear force.

UNIT - II

Flexibility Matrix Method:Determination of Static and kinematic indeterminacy – Equilibrium and compatibility conditions-Principles of superposition, Application of Flexibility Matrix Method to continuous beams, plane trusses, plane frames and ortho grid structures (Static indeterminacy not exceeding three) subjected to Concentrated forces, Uniform forces and Concentrated Moments - Effect of temperature, Lack of fit.

UNIT – III

Stiffness Matrix Method:Application of Stiffness Matrix Method to continuous beams, plane trusses, plane frames and ortho-grid structures (Degree of freedom not exceeding three) subjected to Concentrated forces, Uniform forces and Concentrated Moments.

UNIT – IV

Direct Element Method:Application of direct element method to problems of axially loaded bars, continuous beams, plane trusses and plane frames. Introduction to Structural Analysis software packages.

UNIT – V

Approximate methods of Analysis:

***Substitute Frame Method*:** Substitute frame, Application of Substitute frame method of analysis of frames subjected to transverse loading. Arrangement of Live loads as per IS 456 – 2000.

***Analysis of Frames subjected to Lateral loads*:** Analysis of Building frames subjected to Lateral loads, Portal method and Cantilever method.

Text Books:

1. G .S, Pandit, S. P. Gupta and R. Gupta, *"Theory of Structures",* – Vol. I & II, Tata McGraw Hill, New Delhi,1999.
2. D.S. Prakash Rao, *"Structural Analysis - A Unified Approach",* University Press,1996

Reference Books:

1. J. M. Gere & William Weaver, *"Matrix Analysis of Framed Structures"*, 2nd Ed., D Van Nostand, New Jersey,1980.
2. C.S.Reddy,*"Basic Structural Analysis",*Tata McGraw-Hill Publishing Co. Ltd., 3rd Edition, New Delhi,2010.
3. C.S. Krishna Moorthy, "*Finite Element Analysis"*, McGraw Hill,1991.

For the academic years 2020-2024

GEOTECHNICAL DESIGN

PE 502 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

1. To understanding the necessity and scope of Geosynthetics in Ground Improvement
2. To gain comprehensive understanding about different types of Geosynthetic Products their functions, application and suitability
3. To learn the analysis and design of Reinforced Soil Walls

Course Outcomes:

After completing this course, the student will be able to

1. Identify genesis and classification of Geosynthetic products
2. Analyze and design the application of geotextiles
3. Formulate the design of applications of Geogrids and Geonets
4. Design Geomembrane.
5. Hypothesize Geocomposites and the construction practices.

UNIT – I

***An overview of Geosythetics*:** Introduction – Classification & basic description of Geosythetics – manufacturing process – Over view of Geotextiles, Geogrids, Geonets, Geomembranes and Geocomposites.

Design methods – Design by cost & availability – Design by specification – Design by function

UNIT – II

Geotextile Properties and Test methods – Physical, Mechanical, Hydraulic, Endurance and Degradation properties.

Designing with Geotextiles : Geotextile functions and mechanisms – Designing for separation – Designing for reinforcement – Designing for stabilization – Designing for filtration – Designing for drainage – designing for multi functions.

UNIT – III

Geogrid Properties and Test methods – Physical, Mechanical, Endurance and Environmental properties.

Designing with Geogrids : Designing for geogrid reinforcement

UNIT – IV

Geonets Properties and Test methods – Physical, Mechanical, Hydraulic, Endurance and Environmental properties.

Designing with Geonets : Designing for geonet drainage

UNIT – V

Designing with Geocomposites – Geocomposites for separation – reinforcement – filtration – drainage – liquid/ vapour barriers.

Construction methods & techniques using Geosynthetics

Text Books:

1 Purushothama Raj, P. (2014). *"Ground Improvement Techniques"*. Lami Publishers (P), Ltd. New Delhi
2 Hausman, M. R. (1990). *"Engineering Principles of GroundModification*"McGraw-Hills

Reference Books:

1 Moseley, M.P. (2013), *"Ground Improvement"* Champman and Hall.
2 Koener, R.M. (2012), *"Designing with Geosynthetics, Vol.1 & 2"*, XlibrisCorporation LLC.
3 Rao, G.V. and Raju, G.V.S.S. (1995). *" Engineering with Geosynthetics"*, Tata McGraw Hills.

For the academic years 2020-2024

OPEN CHANNEL FLOWS

PE503CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

1 To develop an understanding of continuity,momentum and energy equations to uniform open channel flow.
2 To learn to apply conservation laws to gradually Varied steady flows
3 To understand the concept of rapidally varied flow in a hydraulic jump,spillway and weir.
4 To learn the concepts of gradually varied unsteady flows.

Course Outcomes:

After completing this course, the student will be able to

1. Analyse continuity, momentum, and energy equations to uniform open channel flow.
2. Apply conservation laws to gradually varied flows.
3. Analyze the behavior of hydraulic jump below the spillways.
4. Analyze the concepts of gradually varied unsteady flows.

UNIT – I

Basic Principles: Introduction to open channels, types of channels, classification of flows, velocity distribution, pressure distribution, pressure distribution in curvilinear flows.

Uniform Flow: Introduction, Chezy's equation, Manning's formula, other resistance formulae, Manning's roughness coefficient, uniform flow computations, hydraulically efficient channel section, compound channels.

UNIT – II

Energy–Depth Relationships: Equation of continuity, energy equation, momentum equation, specific energy, critical depth, calculation of critical depth, transitions.

UNIT – III

Gradually Varied Flow: Introduction, differential equation of GVF, classification of flow profiles, control sections.

Gradually Varied flow Computations: Direct integration of GVF differential equation, step method of solution, simple numerical solutions of GVF problems.

UNIT – IV

Rapidly Varied Flow:Hydraulic Jump- Momentum equation formulation for the jump, hydraulic jump in a horizontal rectangular channel and non-rectangular channels, use of a jump as an energy dissipater, location of the jump.

Rapidly Varied Flow: Ogee spillway, broad crested weir, critical depth flumes, end depth in a free overfall, sluice gate flow.

UNIT – V

Spatially Varied Flows: Introduction, SVF with increasing and decreasing discharge.

Unsteady Flows: Introduction, gradually varied unsteady flow (GVUF), uniformly progressive wave, numerical methods, rapidly varied unsteady flow- positive and negative surges.

Text Books

1. Subramanya K., *"Flow in Open Channels"* (2nd ed.) Tata McGraw Hill, ISBN 00-746-2446-6, New Delhi 2003.
2. Chow Ven-te *"Open Channel Hydraulics"* McGraw Hill, New York NY 1959.

Reference Books

1. Sturm T.W., *"Open Channel Hydraulics"* – 2 nd edition. Tata-McGraw Hill New Delhi 2011. ISBN:978-1-25-900225-0
2. Wurbs R.A., and James W.P. *"Water Resources Engineering"*. Prentice Hall of India, Eastern Economic Edition. ISBN: 81-203-2151-0, New Delhi, 2007.
3. Chaudhry M. H., *"Open Channel Flow",* Prentice Hall of India, Eastern Economic Edition, ISBN: 81-203-0863-8,New Delhi. 1994.

For the academic years 2020-2024

CONSTRUCTION EQUIPMENT AND AUTOMATION

PE 504 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Introduce various construction equipment and study the efficient utilization of the same using scientific principles
2. Identify various construction methods and equipment and associate them with different works in the construction site
3. Attain knowledge in equipment selection for various kinds of activities involved in construction.

Outcomes:

1. Apply the working procedures of equipment for earthwork
2. Understand the role of earth compaction equipments
3. Understand working procedures of material handling and production equipment.
4. Apply the concept & procedure of automation systems and Identify Fire safety Equipment
5. Analyze the various processes of HVAC & Security

UNIT – I

Equipment for Earthwork: Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment –Excavation equipment- Power Shovels, Back Hoe, Drag line, Clamshell – Excavating and Earth Moving Equipment – Scrapers, Bull Dozers, Tractors, Hauling Equipment – Dump trucks, Dumpers Loaders, trucks.

UNIT – II

Equipment for Earth Compaction - Tamping Rollers, Smooth Wheel Rollers, Sheepsfoot Roller, Pneumatic-tyred Roller, Vibrating Compactors, Vibro compaction methods.

Other construction equipment : Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment – Equipment for Demolition, Road making equipment.

UNIT – III

Equipment for material handling - Crushers – Feeders - Screening Equipment – Material handling equipment - Cranes, Hoists, Forklifts and related equipment - Portable Material Bins – Conveyors – Hauling Equipment.

Equipment for aggregate production and concreting - Batching and Aggregate Mixing Equipment - Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment – Ready mix concrete equipment, Concrete mixers, Concrete batching and mixing plant, Transportation of concrete mix, Concrete Pouring and Pumping Equipment, Concrete compaction equipment.

UNIT – IV

Introduction to building automation systems (BAS) - Concept and application of Building Automation System, requirements and design considerations and its effect on functional efficiency, architecture and components of BAS.

Fire alarm system (FAS) standards - Fundamentals: Fire modes, Components, and Principles of Operation. FAS Components: Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. FAS Architectures, loop, Examples. Fire Standards: IS Concept of fire & alarm

system.

UNIT – V

Access control security systems **-** Access Control System: Components, Design. CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, Network design, Storage design. Components. Security Systems, Concepts, Components, Technology, Advanced Applications, Security system design.

Heating, ventilation & air conditioning system **-** HVAC basic processes, Air Properties, Psychometric Chart, Heat Transfer mechanisms, Human comfort zones, Effect of Heat, Humidity, Heat loss. Heating Process & Applications, Cooling Process & Applications, Ventilation Process & Applications. Instrumentation Basics, Field components & use. Air conditioning Components.

Suggested Reading:

1. R.L.Peurifoy – "*Construction Planning and Equipment"* Tata McGraw-Hill Education; 9th Edition, 2018.
2. Mahesh Varma .Dr., "*Construction Equipment and its Planning and Application*", Metropolitan Book Company, New Delhi,2003
3. Sharma S.C. *"Construction Equipment and Management"*, Khanna Publishers, Delhi, 2008
4. Deodhar, S.V. "*Construction Equipment and Job Planning*", Khanna Publishers Delhi, 2008
5. Gagnon. R. "*Design of Special Hazards and Fire Alarm Systems"*, Thomson Delmar, NY, US, 2007
6. Levenhagen, Spethmann. J.I, Donald. "*HVAC Controls and Systems*", McGraw-Hill, SG, 1994

PROFESSIONAL ELECTIVES - II

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

PE 505 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

1. Learn the causes of earthquake and effects of ground motion and modeling of structures.
2. Study the response spectra and structural dynamics of MDOF systems.
3. Learn the seismic analysis of masonry buildings.

Course Outcomes:

After completing this course, the student will be able to

1. Apply the concepts of structural dynamics of MDOF systems for analysis of structures.
2. Model and analyse the structures to resist earthquake forces by different methods.
3. Design the various structural elements resisting earthquake forces as per IS Codes.
4. Practice ductile detailing of reinforced concrete and masonry buildings as per codal provisions.
5. Analyse and design masonry structures for seismic considerations

UNIT-I

Earthquake Ground Motion: Engineering seismology, Seismic zoning map of India, Strong motion studies in India, Strong motion characteristics, Evaluation of seismic design parameters. Structural Dynamics: Initiation into structural dynamics, Dynamics of SDOF systems, Theory of seismic pickup, Numerical evaluation of dynamic response, Response spectra, Dynamics of MDOF systems.

UNIT-II

Concepts of Earthquake Resistant Design of RCC Structures: Basic elements of earthquake resistant design, Identification of seismic damages in RCC buildings, Effect of structural irregularities on performance of RCC buildings during earthquakes, earthquake resistant building architecture.

UNIT-III

Seismic Analysis and Modeling of RCC Structures: Code based procedure for determination of design lateral loads, Infill walls, Seismic analysis procedure as per IS 1893 code, Equivalent static force method, Response spectrum method, Time history analysis, Mathematical modelling of multi-storey RCC buildings.

UNIT-IV

Earthquake Resistant Design of RCC Structures: Ductility considerations, Earthquake resistant design of multi-storey RCC buildings and shear walls based on IS 13920 code, Capacity based design.

UNIT-V

Earthquake Resistant Design of Masonry Structures: Identification of damages and non-damages in masonry buildings, Elastic properties of structural masonry, Lateral load analysis of masonry buildings, Seismic analysis and design of one-storey and two-storey masonry buildings.

Text Book:

1. Bruce A Bolt, *"Earthquakes"*, W H Freeman and Company, New York, 2004.
2. C. A. Brebbia, *"Earthquake Resistant Engineering Structures"*, WIT Press, 2011.

Reference Books:

1. Mohiuddin Ali Khan, *"Earthquake-Resistant Structures: Design, Build and Retrofit, Elsevier Science & Technology"*, 2012.
2. Pankaj Agarwal and Manish Shrikhande, *"Earthquake Resistant Design of Structures"*, Prentice Hall of India, 2009.
3. Paulay, T and Priestley, M.J.N., *"Seismic Design of Reinforced Concrete and Masonry buildings"*, John Wiley and Sons, 1992.
4. S K Duggal, *"Earthquake Resistant Design of Structures"*, Oxford University Press, 2007.

For the academic years 2020-2024

FOUNDATION ENGINEERING

PE 506 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

1. Learn the definition, necessity, types and suitability of different foundationsystems.
2. Understand the procedures of geotechnical design offoundations.
3. Understand the necessity and usage of different foundation construction relatedaspects.
4. Learn about different methods of geotechnical investigations and its role in selection and design of foundations.

Course Outcomes:

1. Apply the stress distribution in soils.
2. Compute the bearing capacity of shallow foundation.
3. Analysis and design pile foundation.
4. demonstrate soil explorations
5. Recommend the type of foundation.

UNIT – I

***Stress Distribution in Soils*:** Boussinesq's theory – Computation of increment in vertical stress due to application of a point load (its distribution on horizontal, vertical planes), uniformly distributed circular and rectangular areas –Pressure bulb – Significant depth - Construction and use of Newmark's chart – Westergaard's theory – Validity of elastic theories – Contact pressure distribution.

UNIT – II

Introduction to Foundations:Functional requirements – types – differentiation of shallow and deep foundations – suitability

Safe Bearing Capacity of Shallow Foundations:Definitions - (a) Based on theories –Types of shear failures - Terazaghi's theory for safe bearing capacity of shallow foundations – Effect of type of shear failure/ shape of the footing / water table – Provisions of IS: 6403-1981 (b) Based on field tests: Plate load test / Standard Penetration test

Allowable Bearing Capacity of Shallow Foundations:Settlement Analysis – Total settlement – Elastic settlement – Consolidation settlement (ultimate & after any given period – correction for constructionperiod) – Permissible uniform & differential settlements – Proportioning offootings.

UNIT – III

Pile Foundations:Necessity – types based on load transfer mechanism / material / method of installation / functional use – Estimation of vertical load carrying capacity of a single pile – static formulae / Dynamic formulae / Pile load tests – Cyclic pile load test for separation of total capacity in to bearing and friction components – Pile groups – necessity – efficiency of Pile groups - estimation of group capacity – Negative Skin friction-- Design of pile foundations.

UNIT – IV

Caissons:Necessity – types – Essential components of open (well) / box (floating) / Pneumatic caissons - suitability – Sinking of caissons – correction for tilt & shift.- Stability of Well Foundations

Coffer dams*:* necessity – types – suitability

UNIT – V

Geotechnical Investigations: Necessity – Principles of exploration - objectives – Soil profile – collection of disturbed & undisturbed soil samples – samplers & quality of samples - methods – Trial pit / Bore hole method – Log of bore hole details

Dewatering: Necessity – methods – sumps (ditches) / well point system (single /multi-stage) / deep well system / electro-osmosis method – merits & demerits – suitability

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Text Books:

1. Bowles, E..-- "*Foundation analysis and Design*", McGraw-HillPublications.
2. Das, B.M. --"*Principles of Foundation Engineering*", SengrecePublications.

Reference Books:

1. Arora, K.R.-- "*Soil Mechanics & Foundation Engineering*" StandardPublications.
2. Verghese, P.C. "*Foundation Engineering*", PHIPublications
3. Punmia, B.C. & Jain A.K -- "*Soil Mechanics & Foundation Engineering*", Laxmi Publications

GROUND WATER ENGINEERING

PE 507CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Course Objectives:

1. Grasp the properties of Ground water and solve for problems on steady flows.
2. Explain the various methods used to calculate parameters of unsteady flow.
3. Describe various geophysical exploration methods and selection of sites
4. Interpret the various artificial methods of ground water recharge, sea water intrusion and its control.
5. Explain conjunctive use of ground water, different ground water analog models.

Course Outcomes:

1. Assess the ground water parameters and flow characteristics, equations
2. Interpret various equations for unsteady radial flow to a well.
3. Understand different methods of geophysical explorations
4. Evaluate the methods of artificial recharge of ground water.
5. Analyse various ground water analog models and hydrologic balance equations

UNIT – I

Introduction: Ground water in the hydrologic cycle, vertical distribution of ground water. Types of aquifers – unconfined, confined and leaky aquifers, porosity, void ratio, storage coefficient, permeability, transmissivity, specific yield, safe yield. General equation of ground water flow, steady undirectional flow, steady radial flow to a well in unconfined and confined aquifers. Steady flow with uniform recharge

UNIT – II

Unsteady Radial Flow to a well: Non equilibrium equation for pumping tests, Theis method of solution, Cooper Jacob method, Chow's methods of solution, law of times, well flow near aquifer boundaries. Image wells, multiple well systems, partially penetrating wells, steady radial flow in leaky artersion aquifer. Well completion and well development

UNIT – III

Geophysical Exploration: Surface investigations of ground water – Electrical Resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, Dowsing. Subsurface Investigations – Test Drilling, resistivity logging, potential logging, Interpretation of logs and selection of site as a well.

UNIT – IV

Artificial Recharge of Ground Water: Methods of recharge, water spreading, sewage discharge, Recharge through pits and shafts, Recharge through well, Induced recharge. Sea water intrusion in coastal aquifers; occurrence, Ghyben-Herzberg relation, space of fresh – salt water interface, length of the intruded sea water wedge, prevention and control of sea water intrusion.

UNIT – V

Ground Water Basin Management: Conjunctive use of surface and ground waters, Hydrologic balance equation. Ground water analog models-sand models, electric analog models, viscous flow models, mathematical modelling.

Text Books:

1. Todd D.K., *"Ground Water Hydrology"*, John Wiley & Sons, Inc., 2011.
2. Ragunath H.M., *"Ground Water"*, Wiley Eastern Limited, 2006.

Reference Books

1. Karnath K.P., *"Ground Water Ananment, Development and Management"*, Tata McGraw Hill Publishing Company, 2017.
2. Bouwer, *"Ground Water Hydrology"*, McGraw Hill, 1979.

For the academic years 2020-2024

SUSTAINABLE CONSTRUCTION METHODS

PE 508 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Understand the significance of modular construction methods.
2. Understand the properties of sustainable energy efficient building materials
3. Know rating systems in detail, including its evolution, objectives, criteria, levels of certification benefits, and shortcomings

Course Outcomes:

1. Apply the techniques of modular construction practices.
2. Understand the basic construction methods in construction projects
3. Applysuitably the innovative and advanced methods of construction
4. Understand the cutting-edge sustainable energy efficient building materials and methods
5. Demonstrate an ability to evaluate and/or design sustainable building rating systems

UNIT – I

Modular Construction Practices - Introduction to formwork - requirements of formwork, loads carried by formwork, types of formwork -timber, steel, slip forms, scaffolding. Modular construction - modular coordination, modular standardization, modular system building, modular shuttering, limitation and advantages of modular construction

UNIT – II

Basic Construction Methods – Construction of foundation and super structure - buildings - precast concrete structures, bridges - steel bridges, arch bridges, cantilever bridges segmental construction, box girders. Construction of special type of bridges such as cable stayed bridge, suspension and pre-stressed bridge.

UNIT – III

Sustainable Construction Materials & Methods – Overview of cutting-edge sustainable energy -efficient building materials, alternative cements and cementitious materials, sustainable issues for concrete, minimization of natural resource utilization, reduction in water consumption in concrete, recycled aggregate, evaluation of their potential to reduce the negative environmental impacts of construction activity, Sustainable construction methods as per Indian Green Building Council (IGBC) , TERIs – Green rating for integrated habitat assessment (GRIHA), ECBC 2017 (Energy Conservation Building Code)

UNIT – IV

Innovative Methods of Construction – Slip form technology, jump form technology, aluminum form technology, tunnel form technology, dry wall technology, plastering machines.

UNIT – V

Sustainable Building Rating Systems - Rating systems for the design, construction, operation, and maintenance of green buildings through Leadership in Energy and Environmental Design (LEED), Case Study of recent green construction projects in India – Certification of LEED Green Associate professional licensing.

Text Books:

1. Roy Chudley and Roger Greeno, "*Construction Technology"*, Prentice Hall, New Delhi, 2005.
2. Peurifoy, "*Construction Planning, Equipment and Methods"*, Tata McGraw Hill Publication, New Delhi, 2001.

Reference Books:

1. Cameron K. Andres, Ronald C. Smith, "*Principles and Practices of Commercial Construction"*, Prentice Hall, New Delhi, 2009
2. Kumar Niraj Jha, "*Formwork for Concrete Structures"*, McGraw Hill Publication, New Delhi, 2004.
3. Allen E, Iano, J, "*Fundamentals of Building Construction*: *Material and Method"*, John Wiley and Sons, 2011.
4. ECBC 2017 (Energy Conservation Building Code)

PROFESSIONAL ELECTIVES - III

ADVANCED CONCRETE TECHNOLOGY

PE 509CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To study the fundamentals of precast technology
2. To know how to make precast construction
3. To understand the advancements of concrete technology

Course Outcomes:

1. Describe the Microstructure of concrete.
2. Apply the concept, composition and properties of Fibre Reinforced Concrete.
3. Apply the concept, composition and properties of Geoploymer Concrete.
4. Describe the fundamentals of precast technology.
5. Describe the fundamentals of prefabricated components.

UNIT I:

Concrete Microstructure:

Cement Hydration products, Formation of gel, Gel-space ratio, Formation of ettringite, Aggregate phase – Hydrated cement phase – Interfacial transition zone – Dimensional stability Alkali Aggregate Reactions, Effect of Sulphates and Chlorides on concrete and reinforcement, Use of supplementary cementitious materials, Advantages

UNIT II:

***Fibre Reinforced Concrete (FRC)*:**

Need for FRC, Types of Fibres, Percentage of fibres, Aspect ratio, Mechanical properties of FRC, Applications of FRC

UNIT III:

Geopolymer Concrete (GPC):

Origin of GPC, Materials of GPC, Use of pozzolonic mineral admixtures – Chemical solutions, Molarity of alkaline solutions, curing at higher temperatures, design principles of GPC, Advantages and applications of GPC

UNIT IV:

Introduction to Precast Technology:

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

UNIT V:

Prefabricated Components:

Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

Text Books:

1. P.Kumar Mehta and Paulo JM Monterio , *"Concrete MicrostructureProperties and Materials"*, Tata McGraw-hill Education, 2009.
2. CBRI, "*Building Materials and Components"*, India, 1990

Reference Books:

1. Gerostiza C.Z., Hendrikson C. and Rehat D.R*., "Knowledge based Process Planning for Construction and Manufacturing"*, Academic Press Inc., 1994
2. Koncz T*., "Manual of Precast Concrete Construction",* Vol. I, II and III, Bauverlag, GMBH, 1976.
3. *"Structural design manual",* Precast concrete connection details, Society for the studiesin the use of precast concrete, Netherland Betor Verlag, 2009
4. IS 1489(Part 1):1991 "*Specification for Portland Pozzolana Cement"* Part 1 Flyash based
5. IS 1727:1967 *"Methods of test for Pozzolanic Materials"*

For the academic years 2020-2024

ROAD SAFETYENGINEERING

PE510CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

The objectives of this course is to

1. understand the concept of capacities and level of service for various types of highways
2. Analyze the accident data and working out strategy to reduce the accidents with different tools and techniques
3. Understanding road user behaviour and vehicular characteristics
4. Design of safe urban infrastructure in view of accidents
5. Learn road safety audit procedures as per code provisions

Course Outcomes:

After completing this course, the student will be able to:

1) Explain the fundamentals of traffic engineering and road safety principles, planning & designing
2) Apply traffic enforcement procedures and processes
3) Design safe road infrastructure
4) Apply design principles for roadway geometrics improvement with various types of traffic safety appurtenances/tools
5) Apply road safety audit at all stages

UNIT – I

Basics of Traffic Engineering –Basic Characteristics of vehicular traffic, capacity and level of service concepts as per Indo- HCM -2017 for urban and rural highways with different lane scenarios. Traffic Control Devices and their applications. Traffic enforcement measures as per Motor vehicle act. Traffic Safety Analysis and its statistics – Regression Methods, Poisson Distribution, Chi- Squared Distribution and other necessary Statistical tests.

UNIT – II

Reasons for Accidents & Its Investigations: understanding the reasons for accidents, Collection of Accident Data from first and secondary sources, analysis of data with help of Condition and Collision Diagrams. Implementation of Traffic enforcement based on the analysis and results. Accident Prevention strategies and plan, Assessment of Road Safety, Identification of block spot locations and its rectifications. Crash Reduction Capabilities and Countermeasures based on block spot data analysis.

UNIT – III

***Road Safety :*Understanding of v**ehicle and road user characteristics, road design and Road side infrastructure in view of accidents, safe designing and re-designing of Junctions, planning of pedestrian facilities and cycle tracks, Road Maintenance, Traffic Control devices soft/hard etc, vehicle specifications and design, Post Accident Care

UNIT – IV

*Safe Urban infrastructure design:*Urban roads and other infrastructure planning and safe design, at Grade and Grade Separated Intersections, medians, public transport stations planning and design, Sustainable Modes and their Safety.

UNIT – V

Road Safety audit: various stages of Road Safety Audits, audit methodology and basic principles, Road Safety Audit Process as per IRC code provisions, preparation of road safety audit reports, action to be taken as per the reports, role of technology in curtailing accidents.

Text Books:

1. KadiyaliL.R. *"Traffic Engineering and Transport Planning*," 10th Edition, Khanna Publishers,2018

Reference Books:

1. IRC- SP-88-2019 New Delhi "Manual on road safety audit" 1st revision published by MORTH. -2019
2. IRC-70-2017 New Delhi "Guidelines on regulation and control of mixed traffic in Urban areas", 1st revision published by Indian Road Congress
3. IRC:86-2018 New Delhi "Geometric Design Standards for Urban Roads and Streets" First revision- 2018, published by Indian Road Congress
4. Lester A. Hoel and Nicholas J. Garber "Traffic and Highway Engineering" Cengage Learning – 2008
5. PapacostasC.S *"Fundamentals of Transportation Engineering"*, Prentice Hall India.
6. RuneElvik, Alena Hoye, TrulsVaa, Michael Sorenson *"Handbook of Road Safety Measures",* Second Edition, Emerald Publishing, 2009.
7. Srinivasa Kumar R *"Introduction to Traffic Engineering"*., Universities Press (India) Limited. 2018.

For the academic years 2020-2024

DESIGN OF IRRIGATION STRUCTURES

PE 511CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Course Objectives:

1. Develop the understanding of basic principles and concepts of analysis and design of
2. hydraulic structures
3. Understand stability and design of weirs, and various seepage theories.
4. Description regarding planning and design aspects of canal systems.
5. Imparting knowledge regarding the types of cross drainage structures.

Course Outcomes:

1. Application of design aspects of different types of weirs and regulatory systems.
2. To analyze the failures of permeable foundations and apply various seepage theories.
3. To apply the various concepts of canal design.
4. To illustrate and analyze various canal regulatory systems.
5. To illustrate and distinguish different types of cross drainage structures.

UNIT – I

Weirs: Components of diversion head works, types of weirs – fixation of still level of head sluice, scouring sluice and crest level of weir, afflux and top level of flood banks, design of head regulator, design of vertical drop and sloping glacis weir, design for surface flow and sub - surface flow, length, level and thickness of downstream apron, upstream and downstream cutoffs, protection works.

UNIT – II

Seepage Forces: Causes of failure of structures on permeable foundations, piping, rupture of floor, undermining, remedial measures, computation of uplift forces by Bligh's theory, Khoshla's theory, analytical method, and significance of exit gradient.

UNIT – III

Canals: Alignment, classification of alluvium canals and their functions, Regime concept of Kennedy's and Lacey's theories, design of canals based on Kennedy's and Lacey's method, use of Garrett's diagrams for the design of canals, lining of canals, methods of lining and design of lined canals.

UNIT – IV

Canal Falls: Definition, location, types of falls, design of trapezoidal notch fall, cylinder fall, vertical drop fall and glacis fall.
Regulators and Modules: Head regulator and cross regulators, canal escapes, canal outlets and modules-proportionality, sensibility and flexibility.

UNIT – V

Cross Drainage Works: Definition, classification, design of aqueducts, syphon aqueducts, super passages, and canal syphons, inlets and outlets-selection of cross drainage works.

Text Books:

1. Punmia, B.C., Pande B. and Lal, B., *"Irrigation and Water Power Engineering"*, 16th edition, Laxmi Publications, 2016.
2. S.K.Garg, *"Irrigation Engineering and Hydraulic Structures"*, 35th edition, Khanna publishers,2016

Reference Books:

1. Modi P.N., *"Irrigation and Water Resources and Water Power Engineering"*, Standard Book House, 2014
2. S.K.Sharma, "*Irrigation Engineering & Hydraulic Structures"* S.Chand Publishers, NewDelhi 2016.
3. U.S.Bureau of Reclamation, "*Design Manual for Concrete Gravity Dams"*, Denver,1976

INFRASTRUCTURE ENGINEERNIG

PE 512 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Description of the design aspects of different types spillways.
2. Knowledge regarding the design of energy dissipation arrangements.
3. Awareness about urban storm drainage and concepts of dam safety.

Course Outcomes:

1. Understand the basic concepts related to Infrastructure Projects.
2. Apply the role of private sector in infrastructure growth.
3. Develop Infrastructure modeling and Life Cycle Analysis Techniques.
4. Demonstrate the strategies for successful Infrastructure Project implementation.
5. Explain Strategies for Successful Infrastructure Project Implementation.

UNIT – I

***Infrastructure engineering*:** Definitions of infrastructure, Governing Features, Urban Infrastructure and Rural Infrastructure in general. An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages in an Infrastructure Project, Concept of Lifecycle., etc., An Overview of Infrastructure Projects in power Sector, Water Supply and Sanitation Sector, Road, Rail, Air and Port Transportation Sectors and Telecommunications.

UNIT – II

***Public & private sector role in infrastructure development*:** A Historical Overview of Infrastructure Privatization, The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization Water Supply, Power, Infrastructure, Road Transportation Infrastructure in India, BOOT, BOT, PPP, HAM, Case studies preferable.

UNIT – III

***Infrastructure planning and management*:** Typical infrastructure planning steps, Planning and appraisal of major infrastructure projects, screening of project ideas, Life cycle analysis, Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding, Economics and Demand Risks, Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Case studies preferable.

UNIT – IV

***Environment and social impact assessment aspects*:** Categories attribute and parameters, identification of environmental & social impacts over project area and over project cycle, special considerations involving land and water interrelation ships – environmental laws and regulations.

UNIT – V

***Strategies for successful infrastructure project implementation*:** Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure, Projects. Governments Role in Infrastructure Implementation, An Integrated Framework for Successful, Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

Text Books:

1. P. Chandra, *"Projects: Planning, Analysis, Selection, Financing, Implementation, and Review"*, Tata McGraw-Hill, New Delhi, 2009.
2. T. Hegazy, "Computer-based Construction Project Management", Prentice Hall, New Jersey,2002.

Reference Books:

1. S. Goodman and M. Hastak, *"Infrastructure Planning handbook: Planning, Engineering, and Economics"*, McGraw-Hill, New York, 2006.
2. Vasant Desai, *"Project Management"*, Himalaya Publishing, 1st Edition, 2010
3. Anjaneyulu, Y &Manickam, V, *"Environmental Impact Assessment Methodology"*, B.S. Publications, Hyderabad, (2012).

OPEN ELECTIVES - I
ELECTRICAL ENERGY CONSERVATION AND SAFETY

OE 601 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To understandthe concepts ofbasicenergyand variousformsofenergy.
2. To understandthe energymanagementand needof energyaudit.
3. To understandtheenergyefficiencytechnologies.

Course Outcomes:

At theend ofthe course studentswillbe ableto

1. Explain thecurrentenergyscenario and importanceofenergyconservation.
2. Describe theconcepts ofenergy management.
3. Recognize themethods ofimprovingenergyefficiencyin differentelectricalsystems.
4. Discuss theconcepts ofdifferentenergyefficientdevices.
5. Explain the basic concepts related to Infrastructure Projects.

UNIT – I

EnergyScenario:CommercialandNon-commercial energy,primaryenergy resources,commercialenergy production,finalenergyconsumption,energyneedsofgrowingeconomy,longterm energyscenario,energy pricing,energysectorreforms,energyandenvironment,energysecurity,energyconservationanditsimportance, restructuring oftheenergy supply sector, energy strategy for the future,airpollution, climatechange.Energy Conservation Act-2001 anditsfeatures.

UNIT – II

BasicsofEnergyanditsvariousforms:Electricity tariff,loadmanagementandmaximumdemandcontrol, powerfactorimprovement,selection&locationof capacitors,Thermal Basics-fuels,thermalenergycontentsof fuel,temperature&pressure,heatcapacity, sensibleandlatentheat,evaporation,condensation,steam,moistair and humidity&heattransfer, units andconversion.

UNIT – III

EnergyEfficiencyinElectricalSystems:Electricalsystem:Electricitybilling,electricalloadmanagement and maximum demandcontrol,powerfactorimprovementanditsbenefit,selectionandlocationofcapacitors, performace assessment ofPFcapacitors,distribution and transformerlosses.Electricmotors: Types, losses in inductionmotors,motorefficiency,factorsaffecting motorperformance,rewinding andmotorreplacement issues, energysavingopportunitieswithenergyefficientmotors.

UNIT – IV

EnergyEfficientTechnologies inElectricalSystems:Maximum demandcontrollers,automaticpowerfactor controllers,energy efficientmotors,softstarterswithenergy saver,variable speeddrives,energy efficient transformers,electronicballast,occupancysensors,energyefficientlightingcontrols,energysavingpotential of eachtechnology.

UNIT – V

Electrical Safety: Physiological effects of Electricity, Important Susceptibility parameters, Distribution of Electric Power, Macro shock hazards, Micro Shock hazards, Electrical - Safety codes and Standards, Basic Approaches to protection against shock, Protection: Power distribution, Protection: Equipment Design, Electrical Safety Analyzers, Testing the Electrical System. Test of Electric Appliances.

Text Books:

1. Guide books for*"NationalCertification ExaminationforEnergyManager/EnergyAuditors"* Book-1, GeneralAspects (availableonline).

Reference Books:

1. Guide books for "*NationalCertification ExaminationforEnergyManager/EnergyAuditors"* Book-3, ElectricalUtilities (available online).
2. S. C. Tripathy, "*UtilizationofElectricalEnergy and Conservation*",McGraw Hill,1991.
3. "*Success storiesofEnergyConservationbyBEE",* New Delhi(www.bee-india.org).

For the academic years 2020-2024

RELIABILITYENGINEERING

OE 602 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Description of the design aspects of different types spillways.
2. Knowledge regarding the design of energy dissipation arrangements.
3. Awareness about urban storm drainage and concepts of dam safety.

Course Outcomes:

At theend ofthe course studentswillbe ableto

1. Describethemeaningofdiscrete and continuousrandomvariablesandtheirsignificance,causesof failuresofasystem.
2. Explaindifferentdistribution functions andtheirapplications.
3. Develop reliabilityblockdiagrams and evaluation of reliabilityofdifferentsystems.

UNIT-I

Discreteandcontinuousrandom variables.Probabilitydensity functionandCumulativedistributionfunction. Meanand variance. Binomial, Poisson, Exponentialand WeibulIdistributions.

UNIT-II

Failureandcauses of failure.Failure rateandfailuredensity.Reliabilityfunctionand MTTF.Bathtubcurvefor differentsystems. Parametric methodsforabove distributions. Non-Parametricmethods fromfielddata.

UNIT-III

Reliability block diagram.Seriesandparallelsystems.Network reduction technique,Examples.Evaluation of failurerate,MTTFandreliability,ActiveandStandbyRedundancy,routofnconfiguration.Non-series–parallel systems. Path basedand cutest methods.

UNIT - IV

Availability,MTTRand MTBF, MarkovmodelsandStatetransitionmatrices. Reliability modelsforsingle component.Twocomponents, Load sharingand standbysystems. Reliabilityand availabilitymodelsoftwo-unit parallelsystemswith repairand standbysystems with repair.

UNIT – V

RepairableSystems.maintainability.Preventivemaintenance,Evaluation ofreliabilityandJ1TTF.Overhauling andreplacement.Optimummaintenancepolicy.Markovmodelofapowerplant with identicalunitsandnon- identicalunits. Capacityoutage probabilitytable. Frequencyoffailuresand Cumulative frequency.

Text Books:

1. CharlesE. Ebeling, *"Reliabilityand MaintainabilityEngineering"*, McGraw HillInternationalEdition, 1997.
2. BalaguruSwamy, *"ReliabilityEngineering"*, Tata McGraw HillPublishingCompanyLtd, 1984.

Reference Books:

1. R.N. Allan, *"ReliabilityEvaluationofEngineeringSystems"*, Pitman Publishing, 1996.
2. Endrenyi, *"ReliabilityModelingin Electric PowerSystems"*,JohnWiley&Sons, 1978.

BASICS OF AUTOMOBILE ENGINEERING

OE 611 AE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Understand the Working of Fuel, Ignition, and cooling Systems
2. Understand the Working of Lubrication and Electrical Systems.
3. Understand the Working of transmission, Suspension, Steering and Braking Systems
4. To provide broad introduction to Alternative Energy Sources, Euro norms and Bharat Norms

Outcomes:

1. Generalize the different types of automobiles and engine components
2. Differentiate the Fuel system and electrical system
3. Describe and differentiate the Transmission Systems
4. To identify different components and working of Steering, Brakes and Suspension systems
5. Adapt techniques, skills and modern engineering tools necessary to control the pollution

UNIT – I

***Vehicle Structure and Engines*:** Types of Automobiles, Vehicle Construction, Chassis, Frame and Body , Components of Engine , Cooling and Lubrication systems in Engine, Turbo Chargers, Engine Emission Control by 3 Way Catalytic Controller, Electronic Engine Management System.

UNIT – II

Engine Auxiliary Systems:Carburettor working principle, Electronic fuel injection system, single-point and Multi-Point Injection Systems, Electrical systems, Battery, generator, Starting Motor and Lighting and Ignition.

UNIT – III

Transmission Systems-Clutch: *Types* and Construction, Gear Boxes-Manual and Automatic, , Over Drives, Transfer Box Fluid flywheel Torque convertors, Propeller shaft – Slip Joint – Universal Joints, Differential and Rear Axle, Hotchkiss Drive and Torque Tube Drive.

UNIT – IV

Steering, Brakes and Suspension:Wheels and Tires – Wheel Alignment Parameters, Steering Geometry and Types of steering gear box, Power Steering, Types of Front Axle – Suspension systems. Braking Systems, Types and Construction, Antilock Braking System.

UNIT – V

Alternative Energy Sources*:* Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles, Electric and Hybrid Vehicles, Fuel Cells. Euro and Bharat Norms. Recent trends.

Text Books:

1. Crouse & Anglin, *"Automotive Mechanics"* Tata McGraw Hill, Publishing Co., Ltd., New Delhi, Tenth edition - 2004.

Reference Books:

1. Kirpal Singh*, "Automobile Engineering"*, Vol I & II Standard Publishers, Delhi.
2. Joseph Heitner, *"Automotive Mechanics"*, Affiliated East West Pvt., Ltd
3. C.P. Nakra, *"Basic Automobile Engineering"*, Dhanpat Rai Publishing Co.(P) Ltd., New Delhi, 2003

For the academic years 2020-2024

INDUSTRIAL ROBOTICS

OE 611ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To familiarize the student with the anatomy of robot and theirapplications.
2. To provide knowledge about various kinds of end effectorsusage.
3. To equip the students with information about various sensors used in industrialrobots.
4. To make the student understand the importance of spatial transformation of robots using forward and inversekinematics.
5. To specify and provide the knowledge of techniques involved in robot vision inindustry.
6. To equip students with latest robot languages implemented in industrialmanipulators.

Course Outcomes:

Student will be able to

1. Demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and have an understanding of the functionality and limitations of robot actuators andsensors.
2. Demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulationtools.
3. Select the best & economically suitable sensors/end effectors required for specificapplications.
4. Understand the importance of robot vision and apply the learnt techniques to get the required information from inputimages.
5. Design and develop a industrial robot for a given purposeeconomically.
6. Appreciate the current state and potential for robotics in new applicationareas.

UNIT – I

Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots, Work envelope, Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications. End effectors, Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers, Two fingered and three fingered grippers, internal grippers and external grippers, Selection and design considerations.

UNIT – II

Requirements of a Sensor: Principles and Applications of the following types of sensors- Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors), Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters), Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors), Touch sensors (Binary sensors, Analog sensors), Wrist Sensors, Compliance Sensors, Slip Sensors.

UNIT – III

Kinematic Analysis of Robots: Rotation matrix. Homogeneous transformation matrix, Denavit&Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis

UNIT – IV

Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3-dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing, sensing and digitizing image data, Signal conversion, Image Storage, Lighting techniques, Image

processing and analysis, Data reduction, Segmentation, Feature extraction, Object recognition, and various algorithms, Applications, Inspection, identification, visual serving and navigation.

UNIT – V

Robot Programming Languages: Characteristics of robot level languages, task level languages. Teach pendant programming, Lead through programming, Robot programming languages, VAL programming, Motion commands, Sensor commands. End effecter commands, Simple programs. RGV, AGV, Implementation of robots in industries, various steps, Safety considerations for robot operations. Economic analysis of robots, Pay back method, EUAC method and Rate of return method.

Text Books:

1. Groover M P, "*Industrial Robotics*", McGraw Hill Publications, 1999.
2. Fu. K.S., Gon Zalez R.C., Lee C.S.G. "*Robotics, Control-sensing vision and Intelligence*", McGraw Hill, Int. Ed., 1987.

Reference Books:

1. Spong and Vidyasagar, "*Robot Dynamics & Control*", John Wiley and Sons, Ed.,1990.
2. Mittal and Nagrath, "*Industrial Robotics*", Tata McGraw Hill Publications, 2004.
3. Saha&Subirkumarsaha, "*Robotics*", TMH, India.

For the academic years 2020-2024

SOFT SKILLS AND INTERPERSONAL SKILLS

OE 601 EG

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Learn conversational skills
2. Learn reading strategies
3. Learn time management
4. Learn stress management
5. Learn career planning

Course Outcomes:

Student will be able to

1. Express conversational skills
2. Specify reading strategies
3. Perform time management
4. Perform stress management
5. Explore career planning

UNIT – I

Conversation skills, Listening dialogues from TV/radio/Ted talk/Podcast
Group discussion
Interview skills, Making presentation
Listening to Lectures and News Programmes, Listening to Talk show
Watching videos on interesting events on Youtube,

UNIT – II

Reading different genres of tests ranging from newspapers to philosophical treatises
Readingstrategies – graphic organizers, Readingstrategies – summarizing
Readingstrategies – interpretation, Reports
Cover letter, Resume,

UNIT – III

Writingfor publications, Letters, Memos, Emails and blogs
Civil Service (Language related), Verbal ability
Motivation, Self image
Goal setting, Managing changes

UNIT – IV

Time management, Stress management
Leadership traits
Team work
Career and life planning.

UNIT – V

Multiple intelligences
Emotional intelligence
Spiritual quotient (ethics)
Interculturalcommunication
Creative and critical thinking
Learning styles and strategies

Text Books:

1. *"Business English Certificate Materials",* Cambridge University Press.
2. *"Graded Examinations in Spoken English and Spoken English for Work downloadable materials*" from Trinity College, London.

Reference Books:

1. *"International English Language Testing System Practice Tests",* Cambridge University Press.
2. *"Interactive Multimedia Programs on Managing Time and Stress".*
3. *"Personality Development (CD-ROM)",* Times Multimedia, Mumbai.
4. Robert M Sherfield and et al. *"Developing Soft Skills"* 4th edition, New Delhi: Pearson Education, 2009.

Web Sources:

1. http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
2. http://www.washington.edu/doit/TeamN/present_tips.html
3. http://www.oxforddictionaries.com/words/writing-job-applications
4. http://www.kent.ac.uk/careers/cv/coveringletters.htm
5. http://www.mindtools.com/pages/article/newCDV_34.htm

OE 602MB

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. Understand management process and functions
2. Comprehend decision making and negotiations
3. Learn psychological contract
4. Study the models of organization behaviour
5. Managing stress and counseling

Course Outcomes:

Student will be able to

1. Explain various facets of management
2. Elaborate on ways of making decision
3. Elucidate different motivation content theories
4. Describe approaches to leadership
5. Suggest methods for stress management and counseling

UNIT – I

Management Process and Functions, Scientific and Modern Management, 3D Model of Managerial Behavior - MBO - MBWA - Line and Staff - The Peter's Principle - Parkinson's Law - Approaches to Organization Structure-Management - Classical, Human Relations, Systems and Contingency Approaches, Hawthorne's Experiments - Human Engineering.

UNIT – II

Decision Making and Negotiations: Approaches to Decision making - Rational, Behavioral, Practical, and Personal Approaches - Open and Closed Models of Decision Making, Types and steps in planning, Authority, Responsibility, Centralization, Decentralization and Recentralization, Bureaucracy.

UNIT – III

Psychological contract - Personality Traits, Big 5 personality traits, MBTI inventory, the Process of Perception - Perceptual distortions and errors, Kelly's personal construct Theory, Motivation-Content Theories: Maslow, Alderfer, Herzberg, McCleland. Process Theories: Vroom, Potter and Lawler, Equity Theory - Goal Theory - Attribution Theory.

UNIT – IV

Models of Organization Behavior - Autocratic, Custodial, Supportive, Collegial and System Models, Transactional Analysis, Johari Window. Group Dynamics: Typology of Groups - Conflicts in groups - The nature, of conflict - Reactions to conflict - A model of conflict. Trait and Behavioral Approaches to Leadership, Managerial Grid, Path-Goal Theory, Vroom's Decision Tree Approach to Leadership - Hersey and Blanchard Model.

UNIT – V

Organization Design, Organization culture and organization climate, Stress Management and Counseling, Management of change and organization development. Communication - Emerging aspects of OB.

Text Books:

1. Harold Koontz and Heinz Weihrich, "*Essentials of Management"*, 9th Edition, McGraw Hill Education, 2015.

2. Curtis W. Cook and Phillip L. Hunsaker, "*Management and Organizational Behavior",* 3rd Edition, McGraw-Hill,2010.

For the academic years 2020-2024

CYBER LAW AND ETHICS

OE 601 LW

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To familiarize various Cyber laws and IT Acts
2. To give cyber security regulations and forensics
3. To study the risk managements and code of ethics

Course Outcomes:

Student will be able to

1. Describe the various Cyber laws and IT Acts
2. Explain the cyber security regulations and forensics
3. Analyse the risks and assessment of implications and code of ethics

UNIT – I

Cyber laws and rights in today's digital age: IT Act, Intellectual Property Issues connected with use and management of Digital Data The similar Acts of other countries

Information Warfare*:* Nature of information warfare, including computer crime and information terrorism; Threats to information resources, including military and economic espionage, communications eavesdropping, computer break-ins, denial-of-service, destruction and modification of data, distortion and fabrication of information, forgery, control and disruption of information How, electronic bombs, and sops and perception management.

UNIT – II

Cyberspace and the Law & Cyber Forensics*:* Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing

UNIT – III

Legal, Ethical, and Professional Issues in Information Security Ethical Component in Information System, Codes of Ethics, Certification Security Analysis: Risk Management, Identifying and assessing risk, and Controlling Risk.

UNIT – IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing.

UNIT – V

Security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Text Books:

1. Nina GodboleandSunitBelpure, *"Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives"*, Wiley 2017
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, *"Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives"*, CRC Press, 2018.

OPERATING SYSTEMS

OE 601 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To understand CPU, Memory, File andDevicemanagement
2. To learn about concurrency control, protectionandsecurity
3. To gain knowledge of Linux and Windows NTinternals

Course Outcomes:

Student will be able to

1. Explain the components and functions ofoperatingsystems
2. Analyze various Schedulingalgorithms
3. Apply the principles ofconcurrency
4. Compare and contrast various memorymanagementschemes
5. Perform administrative tasks on Linux WindowsSystems

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory management, Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring,Encryption.

UNIT-IV

Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

UNIT-V

Case Studies:The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication Windows NT – General Architecture, The NT kernel, The NT executive.

Text Books:

1. Abraham Silberschatz, Peter B Galvin, *"Operating System Concepts"*, Addison Wesley,2006
2. William Stallings, *"Operating Systems-Internals and Design Principles"*, 5th edition, PHI, 2005
3. Andrew S Tanenbaum, *"Modern Operating Systems"*, 4th edition, Pearson,2016

For the academic years 2020-2024

OOP USING JAVA

OE 602 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To introduce fundamental object oriented concepts of Java programming Language such as classes, inheritance, packages andinterfaces
2. To introduce concepts of exception handling and multi-threading
3. To use various classes and interfaces in java collection framework and utility classes To understand the concepts of GUI programming using AWT controls
4. To introduce Java I/O streams and serialization

Course Outcomes:

Student will be able to

1. develop java applications using OO concepts and packages write multi threaded programs with synchronization
2. implement real world applications using java collection frame work and I/O classes
3. write Event driven GUI programs usingAWT/Swing

UNIT – I

Object Oriented System Development*:* understanding object oriented development, understanding object oriented concepts, benefits of object oriented development.

Java Programming Fundamentals*:* Introduction, overview of Java, data types, variables and arrays, operators, control statements.

UNIT – II

Java Programming OO concepts*:* classes, methods, inheritance, packages and interfaces. Exceptional Handling, Multithreaded Programming

UNIT – III

I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling

Exploring Java.Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer

UNIT – IV

Introducing AWT working With Graphics*:* AWT Classes, Working with Graphics.

Event Handling*:* Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces

AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup, Choice Controls, Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog,Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT – V

Java I/O Classes and Interfaces, Files, Stream and Byte Classes, Character Streams, Serialization.

Text Books:

1. Herbert Schildt, *"The Complete Reference JAVA"*, Tata McGraw Hill, 7thEdition,2005
2. James M Slack,*"Programming and Problem Solving with JAVA"*, Thomson learning, 2002
3. C.Thomas Wu, *"An Introduction to Object-Oriented Programming with Java"*, Tata McGraw Hill, 5thEdition,2005**.**

For the academic years 2020-2024

DATABASE SYSTEMS

OE 601 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To understand the basic concept of DBMS
2. To learn to design, develop and query the database
3. To learn database administration and transaction processing

Course Outcomes:

Student will be able to

1. Apply the basic concept of DBMS
2. Design, develop and query the database
3. Develop database administration and transaction processing methods

UNIT – I

Data and Data Management: Role of Data and Databases

Database and Database Management System: Key Database concepts-Basic Database Models-Database Components

Data Modeling: Database Design-Relational Database Models- Relationships-Comparing Data Models

UNIT – II

SQL language: SQL features- command basics-SELECT Fundamentals-Operators and Functions-DDL Commands-DML Commands.

Data Access and Manipulation: SELECT statement Advanced Syntax-Joins and Sub Queries.

SQL Procedures: SQL procedures and Functions-Triggers

UNIT – III

Designing a Database: Designing Relational Tables-Comparing Relational Designs-Normalizing Data.

Implementing a Database: Physical Design and Implementation- Adjusting Design to the Real World-Implementing Database Objects.

UNIT – IV

Improving Data Access: Performance Rollbacks-Using Indexes and Views-Using Programmable objects.

Database Administration:Need for Administration-Administration Responsibilities-Management Task.

UNIT – V

Transactions and Locking: Transaction Basics-Managing Concurrency control-SQL server transaction management.

Database Access and Security: Database Connections-Managing Access Control-Protecting data.

Text books:

1. Mark L. Gillenson, Paulraj Ponniah., "*Introduction to Database Management*", John Wiley & Sons Ltd, 2008.
2. Lee Chao, *"Database Development and Management"*, Auerbach Publications, 2006.
3. Rob Coronel, *"Database Systems: Design, Implementation & Management"* Thomson Course Technology, 2000.

DATA STRUCTURES

OE 602IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To develop proficiency in the specification, representation, and implementation of abstract data types and data structures.
2. To discuss the linear and non-linear data structures and their applications.
3. To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
4. To introduce various internal sorting, searching techniques and their time complexities

Corse Outcomes:

Student will be able to

1. Implement linear, non-linear data structures and balanced binary trees
2. Understand the basic data structures arrays and linked lists.
3. Analyse time complexity of both iterative and recursive functions.
4. Define ADT necessary for solving problems based on Stacks and Queues.
5. Develop solutions using binary trees, advanced search trees, tries and graphs.
6. Use hash functions and handle collisions.

UNIT – I

Performance and Complexity Analysis: Space complexity, Time complexity, Asymptotic notation (big-Oh), complexity analysis examples.
Linear list-array representation: vector representation, multiple lists single array.
Linear list-linked representation: singly linked lists, circular lists, doubly linked lists, Applications (polynomial arithmetic).
Arrays and matrices: row and column major representations, special matrices, sparse matrices.

UNIT – II

Stacks: Array representation, linked representation, applications (recursive calls, infix to postfix, postfix evaluation).
Queues: Array representation, linked representation.
Skip lists and Hashing: skip lists representation, hash table representation, application- text compression.

UNIT – III

Trees: Definitions and properties, representation of binary trees, operations, binary tree traversal.
Binary Search Trees: Definitions, and Operations on binary search trees.
Balanced Search Trees: AVL trees, and B-trees.

UNIT – IV

Graphs: Definitions and properties, representation, graph search methods (Depth First Search and Breadth First Search)
Application of Graphs: shortest path algorithm (Dijkstra), minimum spanning tree(Prim's and Kruskal's algorithms).

UNIT – V

Sorting and Complexity Analysis: Selection sort, Insertion sort, Quick sort, Merge sort, Closest pair of points, and Heap sort.

Text Books:

1. Sartaj Sahni, "*Data Structures--Algorithms and Applications in C++*" 2nd Edition, Universities Press (India) Pvt. Ltd., 2005.

2. Mark Allen Weiss, "*Data Structures and Problem Solving using C++"* Pearson Education International, 2003.
3. Michael T. Goodrich, Roberto Tamassia, David M. Mount "*Data Structures and Algorithms in C++*", John Wiley & Sons, 2010.

For the academic years 2020-2024

DISASTER MANAGEMENT

OE 601 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. To impart knowledge of the basic principles of disaster management.
2. To give knowledge of the various types of disasters.
2. To understand the disaster management cycle and framework.
3. To become aware of the disaster management systems in India.
4. To become aware of the applications of the latest technologies in disaster management

Course Outcomes:

After completing this course, the student will be able to

1. Define and explain the terms and concepts related to disaster management.
2. Describe the various categories of disasters and their specific characteristics.
3. Explain the pre-disaster, during disaster and post-disaster measures and framework
4. Describe the disaster management acts and frameworks specific to India
5. List and explain the various technological applications to aid disaster management.

UNIT-I

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, and Capacity – Disaster and Development, and disaster management.

UNIT-II

Disasters:Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

UNIT-III

Disaster Management Cycle and Framework:Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.

During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation.

Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR.

UNIT-IV

Disaster Management in India:Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies.

UNIT-V

***Applications of Science and Technology for Disaster Management*:** Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs

and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.

Text Books:

1. Rajib, S and Krishna Murthy, R. R, "*Disaster Management Global Challenges and Local Solutions"* CRC Press, 2009.
2. Navele, P & Raja, C. K, "*Earth and Atmospheric Disasters Management, Natural and Manmade". B. S. Publications.2009*

Reference Books

1. Battacharya, T., *"Disaster Science and Management"*. Tata McGraw hill Company, 2017
2. *"Manual on Natural Disaster Management in India"*, M C Gupta, NIDM, New Delhi
3. *"An overview on Natural &Man-made Disasters and their Reduction"*, R K Bhandani, CSIR, New Delhi
4. *"Encyclopedia of Disaster Management"*, Vol I, II and III"Disaster Management Policy and Administration", S L Goyal, Deep & Deep, New Delhi, 2006
5. *"Disasters in India Studies of Grim Reality"*, Anu Kapur& others, 2005, 283 pages, Rawat Publishers, Jaipur
6. *"Disaster Management Act 2005"*, Publisher by Govt. of India
7. *"Publications of National Disaster Management Authority (NDMA)"* on Various Templates and Guidelines for Disaster Management
8. *"National Disaster Management Policy"*, 2009, Govt. of India
9. Jagbirsingh, *"Disaster Management–Future Challenges and Opportunities"*, I.K. International publishing house, 1st edition, 2007.
10. Coppala P Damon, *"Introduction to International Disaster Management"*, Butterworth-Heinemann, 2015.