NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous College under VTU)

(NAAC Accredited with 'A^{+}' Grade, NBA, Accredited)

Syllabus – III Semester M.Tech

STRUCTURAL ENGINEERING

SCHEME AND SYLLABUS

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

Outcome Based Education Curriculum 2022-2024

Department of Civil Engineering

Nagarjuna College of Engineering & Technology
Mudugurki Village, Venkatagiri Kote Post**,**
Devanahalli Taluk,

Bangalore District-562164

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF CIVIL ENGINEERING

VISION

To transform the students as leaders in Civil Engineering to achieve professional excellence in the challenging future

MISSION

M1: To provide the Civil Engineering knowledge and skills for students through an excellent academic environment.

M2: Adopting innovative teaching techniques using modern engineering tools for designing, modeling and analyzing the societal and environmental problems.

M3: Developing Communication skill, leadership qualities through team work and skills for continuing education among the students.

M4: To inculcate moral, ethical and professional values among students to serve the society.

M5: Validate engineering knowledge through innovative research projects to enhance their employability and entrepreneurship skills.

Program Educational Objectives (PEOs)

PEO1: Graduates in Civil Engineering will apply the technical knowledge for sustainable societal growth.

PEO2: Graduates of civil Engineering will demonstrate designing, modeling and analyzing skills.

PEO3: Graduates in Civil Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.

PO4: Civil Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.

PO5: Civil engineering graduates will have the ability to become entrepreneurs thereby switching over from responsive engineering to creative engineering.

Program Outcomes (POs)

PO-1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO-2: An ability to write and present a substantial technical report/document.

PO-3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO-4: Inculcate graduates with qualities of high professional integrity, commitment to societal needs and sustainable development.

PO-5: Use research-based knowledge for innovative projects in Structural engineering.

PO-6: Demonstrate multidisciplinary, individual and teamwork and management principles for entrepreneurship and life-long learning.

Program Specific Outcome (PSO)

PSO-1: Apply the knowledge of Civil Engineering in Sustainable Infrastructure developments.
PSO-2: Identify, analyze and manage Civil Engineering problems with ethical and social responsibilities.
PSO-3: Implementation of relevant codes/ specifications/ guidelines to arrive at comprehensive solutions to address societal needs and exhibit communication and teamwork skills.

Third Semester M.Tech – Scheme

Sl. No	Course	Course Code	Course Title	L:T:P:S (Hrs/week)	Total Credits	Marks (CIE:SEE)	Total Marks
1	PCC	22CSE31	Design of Substructures	4-0-0-0	4	50:50	100
2	PEC	22CSE32X	**Elective- III**	3-0-0-0	3	50:50	100
3	PEC	22CSE33X	**Elective- IV**	3-0-0-0	3	50:50	100
4	Project	22CSE34	Project Phase -1	0-0-6-0	3	100:00	100
5	PR	22CSE35	Mini/Societal Project	0-0-6-0	3	100:00	100
6	IP	22CSE36	Internship	0-0-12-0	6	50:50	100
Total				**10-0-24-0**	**22**	**400:200**	**600**

Elective–I		
1.	22CSE321	Design of Plates and Shells
2.	22CSE322	Design of Precast and Prefabricated Structures
3.	**22CSE323**	**Structural Health Monitoring**
Elective–II		
1.	22CSE331	Composite Materials
2.	**22CSE332**	**Construction Techniques and Management**
3.	22CSE333	Design of Industrial Structures

BSC: Basic Science Course
PCC: Professional Core
IPCC: Integrated Professional core Courses
MCC: Mandatory Credit Course
AUD/AEC: Audit Course/Ability Enhancement Course
PCCL: Professional Core Course Lab
L: Lecture
P: Practical
T: Tutorial

DESIGN OF SUBSTRUCTURES						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE31	**4-0-0**	**4**	**50**	**50**	**3 hours**	**50 Hours**

Prerequisites:

Basic knowledge of Geotechnical Engineering and Structural Analysis

Course Objectives:

The objective of this course is to make students to learn principles of subsoil exploration, To design the sub structures. To evaluate the soil shear strength parameters.

Syllabus

Module – 1

Introduction, Site investigation, In-situ testing of soils, Subsoil exploration, Classification of foundations systems. General requirement of foundations, Selection of foundations, Computations of Loads, Design concepts. Numericals.

(8L+2T)

Module – 2

Concept of soil shear strength parameters, Settlement analysis of footings, Shallow foundations in clay, Shallow foundation in sand & C-Φ soils, Footings on layered soils and sloping ground, Design for Eccentric or Moment Loads. Numericals.

(8L+2T)

Module – 3

Types of rafts, bearing capacity & settlements of raft foundation, Rigid methods, Flexible methods, soil structure interaction, different methods of modeling the soil. Combined footings (rectangular & trapezoidal), strap footings & wall footings, Raft – super structure interaction effects & general concepts of structural design, Basement slabs. Numericals.

(8L+2T)

Module – 4

Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, Laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles.

(8L+2T)

Module – 5

Types of caissons, Analysis of well foundations, Design principles, Well construction and sinking. Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability and design considerations, Ring foundations – general concepts. Numericals.

(8L+2T)

Course Outcomes:

On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the principles of subsoil exploration
- Design and develop analytical skills.
- Identify and evaluate the soil shear strength parameters.
- Understand the concepts of Settlement analysis

Text Books:

- Swami Saran – "Analysis & Design of Substructures"- Oxford & IBH Pub. Co. Pvt. Ltd., 1998.
- Nainan P Kurian – "Design of Foundation Systems"- Narosa Publishing House, 1992.
- R.B. Peck, W.E. Hanson & T.H. Thornburn – "Foundation Engineering"- Wiley Eastern Ltd.,Second Edition, 1984.

Reference Books:

- J.E. Bowles – "Foundation Analysis andDesign"- McGraw-Hill Int. Editions, Fifth Ed., 1996.
- W.C. Teng – "Foundation Design"- Prentice Hall of India Pvt. Ltd., 1983.
- Bureau of Indian Standards:IS-1498, IS-1892, IS-1904, IS-6403, IS-8009, IS-2950, IS-11089, IS-11233, IS-2911 and all other relevant codes.

E-Resources:

- https://www.youtube.com/watch?v=lsYFtwwlHIw&list=PLbRMhDVUMngeiZjKPTPEFl1CByXmYX3Kv

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1	3		1		2		3	2	2
C2	3		2		1		2	3	2
C3	3		1		2		3	2	2
C4	2		3		1		2	3	2
C5	3		2		1		3	3	2
C	2.8		1.8		1.4		2.6	2.6	2

DESIGN OF PLATES AND SHELLS						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE321	**3-0-0**	**3**	**50**	**50**	**3 hours**	**40 Hours**

Prerequisites:

Strength of Materials and Mechanics of Deformable Bodies

Course Objectives:

The objective of this course is to make students to learn different methods of analysis and design of plates and shells, To critically detail the plates, folded plates and shells. To evaluate the performance of spatial structures.

Syllabus

Module – 1

Introduction to plate theory, Small deflection of laterally loaded thin rectangular plates for pure bending. Navier's and Levy's solution for various lateral loading and boundary conditions (No derivation), Numerical examples.

(6L+2T)

Module – 2

Energy methods for rectangular and circular plates with clamped edges subjected to symmetric loadings.

(6L+2T)

Module – 3

Introduction to curved surfaces and classification of shells, Membrane theory of spherical shells, cylindrical shells, hyperbolic paraboloids, elliptic paraboloid and conoids.

(6L+2T)

Module – 4

Axially symmetric bending of shells of revolution, Closed cylindrical shells, water tanks, spherical shells and Geckler's approximation. Bending theory of doubly curved shallow shells.

(6L+2T)

Module – 5

Design and detailing of folded plates with numerical examples Design and Detailing of simple shell problems – spherical domes, water tanks, barrel vaults and hyperbolic paraboloid roofs.

(6L+2T)

Course Outcomes:

On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the principles of Analysis and Design
- Design and develop analytical skills.
- Summarize the performance of shells
- Understand the concepts of energy principle

Text Books:

- Timoshenko, S. and Woinowsky-Krieger, W., "Theory of Plates and Shells" 2ndEdition, McGraw-Hill Co., New York, 1959
- Ramaswamy G.S. – "Design and Constructions of Concrete Shell Roofs" – CBS

Publishers and Distributors – New Delhi – 1986.

- Ugural, A. C. "Stresses in Plates and Shells", 2nd edition, McGraw-Hill, 1999.

Reference Books:

- R. Szilard, "Theory and analysis of plates - classical and numerical methods", Prentice Hall,1994.
- Chatterjee.B.K. – "Theory and Design of Concrete Shell", – Chapman & Hall, NewYork, third edition, 1988.

E-Resources:

- **https://www.youtube.com/watch?v=tA_LGwTvre4&list=PLwdnzlV3ogoXQR59FK4dNDzxb5I65IIuu**
- **https://www.youtube.com/watch?v=CkolEAtY6jY**

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1	3		1		2		3	2	2
C2	2		3		1		2	3	2
C3	3		1		2		3	2	2
C4	3		2		1		3	3	2
C5	3		2		1		2	3	2
C	2.8		1.8		1.4		2.6	2.6	2

DESIGN OF PRECAST AND PREFABRICATED STRUCTURES						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE322	**3-0-0**	**3**	**50**	**50**	**3 hours**	**40 Hours**

Prerequisites:

Basics of Strength of Materials and Structural Analysis

Course Objectives:

Understand the concepts and techniques of precast construction and Select or Design precast elements suitable for project specific requirements.

Design precast systems to ensure integrity and safety of the structure and to Avoid progressive collapse and Design composite floors and beam elements.

Syllabus

Module – 1

Concepts, components, Structural Systems and Design of precast concrete floors

Need and types of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections.

Design of precast Concrete Floors: Theoretical and Design Examples of Hollow core slabs. Precast Concrete Planks, floor with composite toppings with and withoutprops.

(6L+2T)

Module – 2

Design of precast reinforced and pre-stressed Concrete Beams Theoretical and Design Examples of ITB – Full section precast, Semi Precast, propped and unpropped conditions. Design of RC Nibs.

(6L+2T)

Module – 3

Design of precast concrete columns and walls Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints.

(6L+2T)

Module – 4

Design of Precast Connections and Structural Integrity Beam bearing, Beam half Joint, Steel Inserts, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties.

(6L+2T)

Module – 5

Design of Steel Concrete Composite Floors and Beams Composite Floors: Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example.

Composite Beams: Elastic Behavior, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams.

(6L+2T)

Course Outcomes:

On completion of this course, students are able to

- Achieve Knowledge of design of precast sections.
- Design the Structural components

- Design the precast connections
- Design steel and concrete structural components

Text Books:

- Hass A.M. – Precast Concrete – Design and applications Applied Science, 1983.
- David Sheppard – "Plant cast, Precast and Prestressed concrete – McGraw Hill;1989
- NBC – 2005 (Part I to Part VII) BIS Publications, New Delhi, IS 15916- 2011, IS 11447, IS6061 – I and III.

Reference Books:

- R.P. Johnson: Composite Structure of Steel and Concrete (Volume 1), Blackwell Scientific Publication (Second Edition), U.K., 1994.
- IS: 11384-1985, Code of Practice for Composite Construction in Structural Steel and Concrete.

E-Resources:

- **https://www.youtube.com/watch?v=2qV4osntg6g&t=2558s**
- **https://www.youtube.com/watch?v=fRqxXkxApSY&t=74s**

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1	3		1		2		3	2	2
C2	3		2		1		3	3	2
C3	3		2		1		2	3	2
C4	3		1		2		3	3	2
C	3		1.5		1.5		2.75	2.75	2

STRUCTURAL HEALTH MONITORING						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE323	**3-0-0**	**3**	**50**	**50**	**3 hours**	**40 Hours**

Prerequisites:

Knowledge of Concrete Technology and steel structures (Construction Materials) and Basic knowledge about structural dynamics.

Course Objectives:

- Learn the fundamentals of structural health monitoring.
- Study the various vibration-based techniques for structural health monitoring.
- Learn the structural health monitoring using fiber-optic and piezoelectric sensors.
- Study the structural health monitoring using electrical resistance and Electromagnetic techniques.

Syllabus

Module – 1

Introduction to Structural Health Monitoring Definition of structural health monitoring (SHM), Motivation for SHM, SHM as a way of making materials and structures smart, SHM and bio mimetics, Process and pre-usage monitoring as a part of SHM, SHM as a part of system management, Passive and active SHM, NDE, SHM and NDECS, Variety and multi disciplinarity: the most remarkable characters of SHM, Birth of the SHM Community.

(8L+0T)

Module – 2

Vibration-Based Techniques for SHM Basic vibration concepts for SHM, Local and global methods, Damage diagnosis as an inverse problem, Model-based damage assessment, Mathematical description of structural systems with damage, General dynamic behavior, State space description of mechanical systems, Modeling of damaged structural elements, Linking experimental and analytical data, Modal Assurance Criterion (MAC) for mode pairing, Modal Scaling Factor (MSF), Co-ordinate Modal Assurance Criterion (COMAC), Damping, Expansion and reduction, Updating of the initial model, Damage localization and quantification, Change of the flexibility matrix, Change of the stiffness matrix, Strain-energy-based indicator methods and curvature modes, MECE error localization technique, Static displacement method, Inverse eigen sensitivity method,

Modal force residual method, Kinetic and strain energy- based sensitivity methods, Forced vibrations and frequency response functions, Solution of the equation system, Regularization, Parameter subset selection, Other solution methods, Variances of the parameters, Neural network approach to SHM, The basic idea of neural networks, Neural networks in damage detection, localization and quantification, Multi-layer Perceptron (MLP).

(8L+0T)

Module – 3

Fiber-Optic Sensors Classification of fiber-optic sensors, Intensity-based sensors, Phase modulated optical fiber sensors, or interferometers, Wavelength based sensors, or Fiber Bragg Gratings (FBG), The fiber Bragg grating as a strain and temperature sensor, Response of the FBG to uniaxial uniforms train fields, Sensitivity of the FBG to temperature, Response of the FBG to a non-uniform axial strain field, Response of the FBG to transverse stresses,

Photoelasticity in a plane stress state, Structures with embedded fiber Bragg gratings, Orientation of the optical fiber optic with respect to the reinforcement fibers, Ingress/egress from the laminate, Fiber Bragg gratings as damage sensors for composites, Measurement of strain and stress variations, Measurement of spectral perturbations associated with internal stress release resulting from damage spread, Examples of applications in aeronautics and civil engineering, Stiffened panels with embedded fiber Bragg gratings, Concrete beam repair.

(8L+0T)

Module – 4

SHM with Piezoelectric Sensors The use of embedded sensors asacoustic emission (AE) detectors, Experimental results and conventional analysis of acoustic emission signals, Algorithms for damage localization, Algorithms for damage characterization, Available industrial AE systems, New concepts in acoustic emission, State-the-art and main trends in piezoelectric transducer-based acousto-ultrasonic SHM research, Lamb wave structure interrogation, Sensor technology, Tested structures (mainly metallic or composite parts), Acousto-ultrasonic signal and data reduction methods, The full implementation of SHM of localized damage with guided waves in composite materials, Available industrial acoustoultrasonic systems with piezoelectric sensors, Electromechanical impedance, E/M impedance for defect detection in metallic and composite parts, The piezoelectric implant method applied to the evaluation and monitoring of viscoelastic properties.

(8L+0T)

Module – 5

SHM Using Electrical Resistance Composite damage, Electrical resistance of unloaded composite, Percolation concept, Anisotropic conduction properties in continuous fiber reinforced polymer, Influence of temperature, Composite strain and damage monitoring by electrical resistance, unidirectional laminates, Multidirectional laminates, Randomly distributed fiber reinforced polymers, Damage localization. Low Frequency Electromagnetic Techniques Theoretical considerations on electromagnetic theory, Maxwell‘s equations, Dipole radiation, Surface impedance, Diffraction by a circular aperture, Eddy currents, Polarization of dielectrics, Applications to the NDE/NDT domain, Dielectric materials, Conductive materials, Hybrid method, Signal processing, Time-frequency transforms, The continuous wavelet transform, The discrete wavelet transform, Multi resolution, Denoising, Application to the SHM domain, General principles, Magnetic method, Electric method, Hybrid method.

(8L+0T)

Course Outcomes:

On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the Structural components.
- Design and development analytical skills.
- Summarize the principles of Structural health monitoring

Text Books:

- Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, WileyISTE, 2006.
- Douglas E Adams, Health Monitoring of Structural Materials and Components Methods with Applications, John Wiley and Sons, 2007.

- J.P. Ou, H.Li and Z.D. Duan, Structural Health Monitoring and Intelligent Infrastructure,
  Vol-1, Taylor and Francis Group, London, U.K, 2006.

Reference Books:

- Victor Giurglutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.
- Smart Materials and Structures, Gandhi and Thompson
- Structural Health Monitoring: Current Status and Perspectives, Fu Ko Chang.

E-Resources:

- **https://www.youtube.com/watch?v=Y_-OrF8lmio&list=PLyqSpQzTE6M8DM5yAH4VgLMkAXiQV7oDw**
- **https://www.youtube.com/watch?v=It4aogUfQis**
- **https://www.youtube.com/watch?v=IHKoohRHRlI**

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1	3		1		2		3	3	2
C2	3		2		1		3	2	2
C3	3		1		2		3	3	2
C4	3		2		1		2	3	2
C	3		1.75		1.5		2.75	2.75	2

COMPOSITE MATERIALS						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE331	**3-0-0**	**3**	**50**	**50**	**3 hours**	**40 Hours**

Prerequisites:

Basic knowledge on material properties, Structural Analysis and Mechanics of Deformable Bodies.

Course Objectives:

To impart knowledge of composite materials in the context of structural engineering application. To impart a skill of analyzing macro and micro mechanical behavior of composites. To develop introductory knowledge about manufacturing of composites and its failure theories.

Syllabus

Module – 1

Introduction:

Introduction to Composite materials, classifications (thermoset and thermoplastic) and civil/structural engineering applications. Constituent materials of composites – Reinforcements and matrix. Rule of mixture. Selection of materials.

Manufacturing techniques – Hand layup method and compression moulding method. Basics of fiber reinforced composite (Synthetic and natural FR Polymer composites).Advantages and Limitations of composites.

(8L+0T)

Module – 2

Macro-mechanical Behaviour of a Lamina: Introduction, Stress-Strain Relations For Anisotropic Materials. Stiffness's, compliances, and engineering constants for orthotropic materials. Restrictions on engineering constants. Numerical problems. **(6L+2T)**

Module – 3

Macro-mechanical Behaviour of a Lamina contd...

Stress-strain relations for plane stress in an orthotropic material. Stress-strain relations for a lamina of arbitrary orientation. Invariant properties of an orthotropic lamina. Strengths of an orthotropic lamina, thermal and mechanical stress analysis. Numerical problems.

(6L+2T)

Module – 4

Micro-mechanical behaviour of a lamina: introduction, mechanics of materials approach to stiffness. Determination of E_1. Determination of E_2. Determination of v_{12}. Determination of G_{12}. Numerical problems. **(6L+2T)**

Module – 5

Classical composite lamination theory, cross and angle – play laminates, symmetric, antisymmetric and general symmetric laminates. Mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories concepts-Maximum Stress Failure Criterion, Maximum Strain Failure Criterion and Tsai-Hill Failure Criterion. Numerical Problems.

(6L+2T)

Course Outcomes:

On completion of this course, students are able to

- Define and classify the composite materials.
- Analyze the macro-mechanical behaviour of composites.
- Derive the engineering constants of composites.
- Select the appropriate constituent materials for composite manufacture

Text Books:

- Mechanics of Composite Materials and Structures by M. Mukhopadhya-Universities Press 2009
- Robart M.Jones, " **Mechanical of Composite Materials**"- McGraw Hill Publishing Co.

Reference Books:

- Bhagwan D Agarvalm, and Lawrence J Brutman, " **Analysis and Performance of Fiber Composites**"- John Willy and Sons.
- Autar K. Kaw, Mechanics of Composite Materias, Second edition., CRC Press,2006.

E-Resources:

- **https://www.youtube.com/watch?v=0kB0G6WKhKE&list=PLSGws_74K01-bdEEUElQ9-obrujIKGEhg**

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1	3		2		1		2	3	2
C2	3		1		2		2	3	3
C3	3		1		2		2	3	2
C4	3		2		1		3	3	2
C	3		1.5		1.5		2.25	3	2.25

CONSTRUCTION TECHNIQUES AND MANAGEMENT						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE332	**3-0-0**	**3**	**50**	**50**	**3 hours**	**40 Hours**

Prerequisites:

Basic knowledge of Construction Process and Project Management

Course Objectives:

This course will enable students to

- Understand the various management techniques for successful completion of construction projects.
- Understand the effect of management for project organization.

Syllabus

Module – 1

Introduction: Construction Projects-Concept, Project Categories, Characteristic of projects, project life cycle phase. Project Management- Project Management Function, Role of Project Manager. Organizing For Construction - Principles of organization, type of organization structure.

(6L+2T)

Module – 2

Project Feasibility Reports: Introduction, Significance in feasibility report Technical analysis, Financial analysis, Economic analysis, Ecological analysis, Flow Diagram for feasibility study of a project. Project planning Scope: Planning Process, Objectives, Types of Project plans, Resource Planning Process.

(6L+2T)

Module – 3

Project management techniques: Bar charts, Milestone charts, work breakdown structure, PERT and CPM networks, elements of networks, network construction, numbering the events, time estimates, expected time, project duration, critical path and critical activities and related problems. Drawing A-O-N network from A-O-A network and related problems. **(6L+2T)**

Module – 4

PERT networks: Event times, locating critical path using Slack values, Probability of meeting the scheduled time of completion and related problems.

CPM networks: Activity times, criticality of an activity, locating critical path using Float values and related problems.

(6L+2T)

Module – 5

Time Cost relationship: Direct and indirect cost, steps in optimization of cost and related problems. Allocation of resources: Histograms, Resource smoothening, Resource leveling and related problems. Project updating using CPM network and related problems.

(6L+2T)

Course Outcomes:

On completion of this course, students are able to

- Recognize the nature of construction industry and the importance of management.
- Apply knowledge on preparing project plans, schedule of construction, and project organization.
- Formulate and solve problems on construction network and time estimates.
- Identify and apply time cost tradeoff principles and cost control in construction.

Text Books:

- Chitkara, K.K. **"Construction Project Management: Planning, Scheduling and Control"**, Tata McGraw-Hill Publishing Company, New Delhi, 1998
- Choudhury S, **"Project Management"**, McGraw-Hill Publishing Company, New Delhi, 1988.
- Chris Hendrickson and Tung Au, **"Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders"**, Prentice Hall, Pittsburgh, 2000.

Reference Books:

- Srinath L.S, **"PERT and CPM"**, East West Press Pvt Ltd New Delhi.
- Frank Harris and Roland McCaffer, **"Modern Construction Management"**- 4th Ed. Blackwell Science Ltd.

E-Resources:

- **https://swayam.gov.in**
- **https://nptel.ac.in**
- **http://elearning.vtu.ac.in**

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1	1		2			3	2	3	3
C2	3			1		2	2	3	2
C3	3		1		2		2	3	3
C4	3		1		2		2	3	3
C5	2.4		1.3	1	2	2.5	2	3	2.75

DESIGN OF INDUSTRIAL STRUCTURES						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE333	**3-0-0**	**3**	**50**	**50**	**3 hours**	**40 Hours**

Prerequisites:

Basic knowledge of steel structures and structural analysis of RCC structures

Course Objectives:

The objective of this course is to make students to learn principles of Design of industrial building, To design different components of industrial structures and to detail the structures. To evaluate the performance of the Pre-engineered buildings.

Syllabus

Module – 1

Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames.

(6L+2T)

Module – 2

Analysis and design of gantry column (stepped column / column with bracket), purlins, girts, bracings including all connections.

(6L+2T)

Module – 3

Analysis of transmission line towers for wind load and design oftowers including all connections.

(6L+2T)

Module – 4

Forms of light gauge sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light gauge sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength.

(6L+2T)

Module – 5

Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light gauge sections, Design of flexural members (Laterally restrained / laterally unrestrained).

(6L+2T)

Course Outcomes:

On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the industrial building and the components.
- Design and develop analytical skills.
- Summarize the principles of Structural Design and detailing.
- Understands the concept of Pre- engineered buildings.

Text Books:

- B.C. Punmia, A.K. Jain “Design of Steel Structures”, Laxmi Publications, New Delhi.
- Ramchandra and Virendra Gehlot “ Design of Steel Structures “ Vol 1 and Vol.2, Scientific Publishers, Jodhpur

- Duggal “Limit State Design of Steel Structures” TMH

Reference Books:

- Bureau of Indian Standards, IS800-2007, IS875-1987, IS-801-1975. Steel Tables, SP 6(1) – 1984
- N Subramanian- “Design of Steel Structure” oxford University Press

E-Resources:

- **https://www.youtube.com/watch?v=qJV5zdx7NJs**
- **https://www.youtube.com/watch?v=5nLJHnCUMRI**

PO'S CO’S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1	3		1		2		3	3	2
C2	2		1		3		2	3	2
C3	3		1		2		3	3	2
C4	2		1		3		2	3	2
C5	3		1		2		2	3	2
C	2.6		1		1.4		2.2	3	2

PROJECT PHASE - 1						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE34	**0-6-0**	**3**	**100**	**00**	**--**	**--**

Course Objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Seminar: Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes:

On completion of this course, students are able to

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1				1	3	2	2	3	2
C2	1		2		3		2	3	3
C3	3		1		3		3	3	2
C4			1	2		3	2	3	2
C5		1		3		2	2	3	2
C	2	1	2	2	3	2.3	2.2	3	2.2

MINI/SOCIETAL PROJECT						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE35	**0-6-0**	**3**	**100**	**00**	**--**	**--**

Course Objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Seminar: Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes:

On completion of this course, students are able to

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1				1	3	2	2	3	2
C2	1		2		3		2	3	3
C3	3		1		3		3	3	2
C4			1	2		3	2	3	2
C5		1		3		2	2	3	2
C	2	1	2	2	3	2.3	2.2	3	2

INTERNSHIP						
Course Code	**L-T-P (Hrs/week)**	**Credits**	**CIE Marks**	**SEE Marks**	**SEE Duration**	**Total Lecture Hours**
22CSE36	**0-12-0**	**6**	**50**	**50**	**3 Hours**	**--**

Course Objectives:

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently

Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes:

On completion of this course, students are able to

- Acquire knowledge of the industry in which the internship is done.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics.

PO'S CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C1				3	2	1	2	3	2
C2			1	3		2	2	3	2
C3		3		2		1	2	3	2
C4		1		2		3	2	3	2
C5			1	2		3	2	3	2
C		2	1	2.4	2	2	2	3	2