ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2020 Rank Band: 201-250

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
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# DEPARTMENT OF CIVIL ENGINEERING

## PG – M.Tech.
## Structural and Construction Engineering

## PRR - 20
## SYLLABI, SCHEME OF INSTRUCTION & EVALUTION

**(I Semester to IV Semester)**

**(Applicable from the Academic Year 2020-21)**

**DEPARTMENT OF CIVIL ENGINEERING**
**KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15**
*(An Autonomous Institute under Kakatiya University, Warangal)*
**SCHEME OF INSTRUCTION & EVALUATION OF**
# M.TECH. (STRUCTURAL AND CONSTRUCTION ENGINEERING)

**PRR-20**

## SEMESTER-I

| Sr. No. | Course Type | Course Code | Course Name | Teaching scheme | | | Credits | Evaluation Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIE –TA | | | | | | | ESE | Total Marks |
| | | | | | | | | I²RE | | | | Minor | MSE | Total | | |
| | | | | L | T | P | | ATLP | CRP | CP | PPT | | | | | |
| 1 | PC | P20SC101 | Limit Analysis of Reinforced Concrete Structures | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 2 | PC | P20SC102 | Construction Management | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 3 | PE | P20SC103 | Professional Elective-I/ MOOC-I | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 4 | PE | P20SC104 | Professional Elective-II/ MOOC-II | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 5 | PC | P20SC105 | Structural Engineering Laboratory | - | - | 4 | 2 | - | - | - | - | - | - | 60 | 40 | 100 |
| 6 | PC | P20SC106 | Construction Planning and Scheduling Laboratory | - | - | 4 | 2 | - | - | - | - | - | - | 60 | 40 | 100 |
| 7 | MC | P20MC107 | Research Methodology & IPR | 2 | - | - | 2 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 8 | AC | P20AC108 | Audit Course-I | 2 | - | - | 1 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| | | | Total: | 16 | - | 8 | 19 | | | | | | | 480 | 320 | 800 |

**[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]**

**Elective-1**
P20SC103A: Matrix Analysis of Structures
P20SC103B: Design of Concrete Bridges
P20SC103C: Precast Concrete Technology
P20SC103D: MOOCs

**Elective-2**
P20SC104A: Behaviour of Concrete
P20SC104B: Construction Project Administration
P20SC104C: Building Services
P20SC104D: MOOCs

**Audit Course-1**
P20AC108A: English for Research Paper Writing
P20AC108B: Sanskrit for Technical Knowledge
P20AC108C: Constitution of India
P20AC108D: Pedagogy Studies

**Total Contact Periods/Week: 24** **Total Credits: 19**

## P20SC101 : LIMIT ANALYSIS OF REINFORCED CONCRETE STRUCTURES

**Class:** M.Tech. I – Semester **Specialization:** Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students' knowledge in/on…
*LO1: concepts of limit state design in flexure and moment curvature relationships for RC beams*
*LO2: behaviour of columns under combined loading*
*LO3: analysis of beams in shear and torsion*
*LO4: concept of serviceability and analysis of slabs by yield line theory*

### UNIT-I (9)

**Limit State Design:** Behaviour of the materials, design philosophies of working stress, ultimate load method and limit state method, application of limit state collapse in flexure

**Moment-Curvature:** Deformation and ductility of members in flexure, moment-curvature relationships, curvature of a member, theoretical moment-curvature determination

### UNIT-II (9)

**Behaviour of Columns:** Types of columns, load carrying capacity of columns, construction of interaction curves for uniaxial bending and bi-axial bending of rectangular and circular columns

**Design of Columns:** Design considerations, design of uniaxial, bi-axial, long, slender for rectangular and circular columns

### UNIT-III(9)

**Shear:** Behaviour of RC elements in shear, principal mechanism of shear resistance, beam and arch action, mode of shear failure, shear failure mechanisms, shear strength of beam with and without shear reinforcement

**Torsion:** Behaviour of RC elements in torsion, types of torsion, behaviour plain concrete beams under torsion, skew bending and space truss analogy for RC members, combined bending and torsion, combined shear and torsion, design of beams in combined shear, bending and torsion as per is code

## UNIT-IV (9)

**Serviceability:** Limit state of serviceability, short term deflections, long term deflections, total deflections, cracks in RC members, calculation of crack width

**Yield Line Theory:** Yield line theory of slabs, behaviour of slabs up to failure, yield criteria, methods of analysis using virtual and equilibrium method, design of slabs

**Text Books:**


[1] S.Unnikrishna Pillai and Devdas Menon, *Reinforced Concrete Design,* 3rd ed. New Delhi: McGraw Hill Education, 2017. (*Chapters 1, 2, 4, 6, 7, 10 and 13)*

[2] R. Park and T. Paulay, *Reinforced Cement Concrete Structures*, 3rd ed. New Delhi: MISL-WILEY Series, Wiley India Pvt. Ltd., 2009.(*Chapter 6)*


**Reference Books:**


[1] B.C. Punmia, Er. Ashok Kumar Jain and Arun K. Jain, *R.C.C. Design (Reinforced concrete structures)*, 10th ed. New Delhi: Laxmi Publications Pvt. Ltd., 2014.

[2] P.C. Varghese, *Advanced Reinforced Concrete Design*, 2nd ed. Prentice Hall India Learning Pvt. Ltd., 2010.

[3] C.K. Wang, C G Salmon et al., *Reinforced Concrete Design*, 8th ed. Oxford University Press, 2017.

[4] BIS, IS 456: 2000, *Plain and Reinforced Concrete- Code of Practice*, 5th amendment, New Delhi: Bureau of Indian Standards, 2019.

[5] BIS, IS: 875 (part 1-5), *Code of practice for Design loads*, New Delhi: Bureau of Indian standards, 1987.

[6] BIS, SP: 16, *Design Aids for Reinforced Concrete to IS 456: 1978*, New Delhi: Bureau of Indian standards, 1980.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: apply the concepts of limit state method in flexure and develop the moment curvature relationships for RC beams*

*CO2: analyze and design of compression members*

*CO3: design beams for shear and torsion*

*CO4: estimate the deflection, crack width in RC structures and yield line theory of slabs*

| **Course Articulation Matrix (CAM): P20SC101 : LIMIT ANALYSIS OF REINFORCED CONCRETE STRUCTURES** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC101.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC101.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC101.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC101.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC101** | | 1 | 1 | 1 | 1 | 1 |

## P20SC102 : CONSTRUCTION MANAGEMENT

**Class:** M.Tech. I – Semester **Specialization:** Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
*LO1: elements of construction management and specifications of contracts*
*LO2: project scheduling and cost management*
*LO3: project control and equipment management*
*LO4: cost analysis of project, valuation of land and property*

### UNIT – I (9)

**Elements of Construction Management:** Stages of construction project, construction team and their functions, functions of construction management, project feasibility studies - technical, financial, economic and ecological analysis, steps in planning, principles of planning, stages of planning

**Construction Contracts and Specifications:** Considerations in contract, contract documents, types of contracts – lump-sum, cost-plus fixed fee, cost-plus bid fee, guaranteed maximum, negotiated, unit price, design build, turn-key, specifications, types of specifications

### UNIT – II (9)

**Project Planning and Scheduling:** Methods of scheduling, network techniques, activity, event, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), time estimates, floats and slacks

**Time and Cost Relationship:** Direct and indirect cost of project, total project cost, optimization of project cost through contraction - cost slope and crashing of activities, basics of resource allocation, leveling and smoothing

### UNIT – III (9)

**Project Planning &Control:** Changes in project plan, Rescheduling activities, changes in duration of an activity, methods of updating, data required for updating

**Management of Construction Equipment:** Need for mechanization, financial aspects of plants and machineries, factors affecting the selection of equipment, factors affecting the cost of owning and operating the construction equipment

## UNIT – IV (9)

**Construction Economics:** Economic analysis of construction projects, economic studies – primary economic comparisons, break-even analysis, time-based studies – cash flow forecasting, investment appraisal, sensitivity analysis

**Valuation Engineering:** Cost and value, purpose of valuation, factors affecting the value of property, valuation classification, sinking fund, capitalized value, obsolescence, depreciation, valuation of land and property

**Text Books:**


[1] S. Seetharaman, *Construction Engineering and Management,* 5th ed.New Delhi:Umesh Publications, 2017. *(Chapters 2-10, 13, 14, 15,17,18,23 and 25)*

[2] B. L. Gupta, *Construction Management, machinery and accounts*,3rded.Standard Publishers 2016. *(Chapters 1, 2, 3, 5-12 and 15)*


**Reference Books:**


[1] K. N. Jha, *Construction Project Management – Theory and Practice*, 3rded. Noida: Pearson India Publishers, 2016.

[2] L. S. Srinath, *PERT and CPM principles and applications,* East West Press, 2011.

[3] SubhajitSaraswati, *Construction Technology*, Oxford University Press, 2017.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: interpret the process of construction management and tendering*
*CO2: estimate the project duration and cost of a project*
*CO3: anticipate project completion and judge equipment for construction*
*CO4: estimate cash flow for a project and property value*

| Course Articulation Matrix (CAM): P20SC102 : CONSTRUCTION MANAGEMENT | | | | | | |
|---|---|---|---|---|---|---|
| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
| CO1 | **P20SC102.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC102.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC102.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC102.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC102** | | 1 | 1 | 1 | 1 | 1 |

## P20SC103A MATRIX ANALYSIS OF STRUCTURES

**Class:** M.Tech. I – Semester

**Specialization:** Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**

This course will develop students' knowledge in/on…

*LO1: flexibility matrix method and its applications to beams*

*LO2: application of flexibility matrix method to frames and truss elements*

*LO3: stiffness matrix method and its applications to beams*

*LO4: application of stiffness matrix method to frames and truss elements`*

### UNIT – I (9)

**Flexibility Matrix Method:** Basics, Review of matrix algebra, Force method, basic concepts, internal forces, external loads and redundant, relation between internal forces and deformation, determination of static indeterminacy for different types of structures, development of flexibility matrix for beams

**Flexibility Matrix Method for Beams:** Determination of internal and external static indeterminacy for different types of structures, Analysis of continuous beams up to second degree of static indeterminacy, bending moment and shear force diagrams

### UNIT – II (9)

**Flexibility Matrix Method for Frames:** Analysis of rectangular portal frames – second degree of static indeterminacy, bending moment and shear force diagrams

**Flexibility Matrix Method for Trusses:** Analysis of statically indeterminate plane trusses up to second degree of static indeterminacy, application of flexibility method to pin jointed members and stresses due to lack of fit

### UNIT – III (9)

**Stiffness Matrix Method:**Basics, Stiffness matrix method, kinematic indeterminacy, determination of kinematic indeterminacy for different types of structures, development of stiffness matrix for beams

**Stiffness Matrix Method for Beams:**Determination of kinematic indeterminacy for different types of structures, analysis of continuous beams up to second degree of kinematic indeterminacy, bending moment and shear force diagrams

## UNIT – IV (9)

**Stiffness Matrix Method for Frames**:Analysis of rectangular portal frames up to second degree of kinematic indeterminacy, bending moment and shear force diagrams

**Stiffness Matrix Method for Trusses:** Analysis of statically indeterminate plane trusses-up to second degree of kinematic indeterminacy, application of stiffness method to pin jointed trusses

**Text Books:**


[1] G.S. Pandit and S.P. Gupta, *Structural Analysis - A Matrix Approach*, 2nded.New Delhi: McGraw Hill Education Pvt. Ltd., 2017. (*Chapters 1, 2, 4 - 6 and 7)*

[2] Weaver and Gere, *Matrix Analysis of Framed Structures*, 3rd ed. New Delhi: CBS Publishers & Distributors, 2012. (*Chapters 1- 4 and 6)*


**Reference Books:**


[1] Bhavikatti. S.S, *Matrix methods of Structural Analysis,* New Delhi: I K International Publishing House, 2011.

[2] C. Natarajan and P. Revathi, *Matrix methods of Structures Analysis,* New Delhi: PHI Learning Pvt. Ltd., 2014.

[3] C.S. Reddy, *Basic Structural Analysis,*3rd ed. New Delhi: Tata McGraw Hill Education Pvt. Ltd., 2017.


**Course Learning Outcomes (COs):**
On completion of this course, students will be able to...

*CO1: develop the flexibility matrix to analyze beams*
*CO2: estimate the forces in frames and trusses by flexibility matrix method*
*CO3: formulate stiffness matrix to analyse beams*
*CO4: evaluate the forces in frames and trusses using stiffness matrix method*

| **Course Articulation Matrix (CAM): P20SC103A MATRIX ANALYSIS OF STRUCTURES** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC103A.1** | - | 1 | 1 | 1 | 1 |
| CO2 | **P20SC103A.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC103A.3** | - | 1 | 1 | 1 | 1 |
| CO4 | **P20SC103A.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC103A** | | 1 | **1** | **1** | **1** | **1** |

## P20SC103BDESIGN OF CONCRETE BRIDGES

**Class:**M.Tech. I – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
*LO1: loading and design considerations in bridges*
*LO2: RCC deck slab and T-Beam bridges*
*LO3: types of bridge bearings and bridge appurtenances*
*LO4: elements of bridge sub-structure*

### UNIT-I (9)

**Bridge Loading:** Types of bridges, materials for construction, codes of practice (railway and highway bridges), design loads and IRC standard loading
**Hydraulic Design:**Planning and layout of bridges, hydraulic design, geological and geotechnical considerations

### UNIT-II (9)

**Deck Slab Bridge:** Design of reinforced cement concrete road bridge as per IRC loading
**T-Beam Bridge:** Analysis of beams, Courbon's method, Pigeaud's curve method for design of interior slab panel, design of t-beam bridge

### UNIT-III (9)

**Bearings**: Types and functions of bearings, forces on bearings, bearing materials, design of elastomeric pad bearing
**Bridge Appurtenances**: Expansion joints, design of joint railings, drainage systems and lighting

### UNIT-IV (9)

**Sub-Structure**: Loads acting on substructure, Design of pier and pier cap, stability analysis of abutments, retaining and wing walls
**Bridge Foundations:** Types of foundation, Design of shallow and deep foundations

**Text Book:**

[1] T.R. Jagdish and M.A. Jayaram, *Design of Bridge Structures*, 2nd ed. New Delhi: PHI Learning Pvt. Ltd., 2009.

**Reference Books:**


[1] N. Krishna Raju, *Design of Bridges,* 5thed. New Delhi: Oxford &IBH Publishing Co. Pvt. Ltd., 2019.

[2] D. Johnson Victor, *Essentials of Bridge Engineering*, 6th ed. New Delhi: IBH Publishing Co. Ltd., 2019.

[3] IRC 5: 2015 *Standard Specifications and Code of Practice for Road Bridges*, 8th revision, New Delhi: The Indian Road Congress, 2015.

[4] IRC 6: 2014 *Standard Specifications and Code of Practice for Road Bridges*, 5th revision, New Delhi: The Indian Road Congress, 2014.

[5] IRC 21: 2000 *Standard Specifications and Code of Practice for Road Bridges*, 3rd revision, New Delhi: The Indian Road Congress, 2000.

[6] BIS, IS 456:2000, *Code of practice for Plain and reinforced concrete*, 5th revision,New Delhi: Bureau of Indian standards,2000.


**Course Learning Outcomes (Cos):**

On completion of this course, Students will be able to…

*CO1: describe loads and design specification for bridges*

*CO2: design RCC deck slab and T-Beam bridge*

*CO3: recommend types of bearing and appurtenances*

*CO4: evaluate the behavior of sub-structure elements*

| **Course Articulation Matrix (CAM): P20SC103B DESIGN OF CONCRETE BRIDGES** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC103B.1** | 1 | - | 1 | 1 | - |
| CO2 | **P20SC103B.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC103B.3** | 1 | 1 | 1 | 1 | - |
| CO4 | **P20SC103B.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC103B** | | **1** | **1** | **1** | **1** | **1** |

## P20SC103CPRECAST CONCRETE TECHNOLOGY

**Class:**M.Tech. I – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 40 |
| End Semester Examination | 60 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
*LO1: materials used for precast concrete*
*LO2: behaviour of precast concrete structural components*
*LO3: production and erection methods of precast elements*
*LO4: applications of precast technology and its structural integrity*

### UNIT-I (9)

**PrecastConcrete:** Definitions, advantages and disadvantages, type standardisation and component standardisation, precast superstructure, structural stability, precast design concepts

**Materials:** Concrete - for precast production, for precast floor elements, young's modulus, shrinkage and creep, admixtures, reinforcements, structural steel etc., non-cementitious material

### UNIT-II (9)

**Frame Analysis:** Types of precast concrete structures, simplified frame analysis, sub structuring method, strength and serviceability requirements, connection designs, stabilizing methods, standard design of beam, column and slab

**Behaviour of Structural Components**: Construction of roof and floor slabs, wall panels, columns, shear walls, joints and connections, classification of joints, joints for different structural connections, beam and column - connections types and classifications

### UNIT-III (9)

**Production:** Production technology, Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening

**Hoisting:** Hoisting technology, equipment for hoisting and erection, techniques for erection of members like beams, slabs, wall panels and columns, vacuum lifting pads

### UNIT-IV (9)

**Applications:** Applications, designing and detailing of precast unit for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, single span, single storied simple frames, single storied buildings, slabs, beams and columns
**Structural Integrity:** Progressive collapse, codal provisions, equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., importance of avoidance of progressive collapse

**Text Books:**

[1] Kim S. Elliott, *Precast Concrete Structures*,2nd ed. New York: CRC Press, 2017.

**Reference Books:**

[1] ICI Bulletin, *Handbook on Precast concrete Structures,* 1st ed. Chennai: Indian Concrete Institute, 2016.
[2] Kim S. Elliott and Colin K. Jolly, *Multi-Storey Precast Concrete Framed Structures*, 2nd ed. UK: Wiley Blackwell, 2013.
[3] Mokk, *Prefabricated Concrete for Industrial and Public Structures*, 8th ed. Budapest: Publishing House of the Hungarian Academy of Sciences, 1964.
[4] Koncz. T, *Manual of precast concrete construction, Vol. I, II and III*, 7th ed. GMBH: Bauverlag, 1971.
[5] CBRI, *Building materials and components*, 1st ed. India: CSIR Roorkee, 1990.
[6] Structural design manual, *Precast concrete connection details, Society for the studies in the use of precast concrete,* 1st ed.Netharland:Netherland Betor Verlag, 1978.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to...

*CO1: identify materials used for precast concrete*
*CO2: analyze the structural elements of precast concrete*
*CO3: illustrate production and erection methods of precast elements*
*CO4: evaluate precast systems and structural integrity*

**Course Articulation Matrix(CAM): P20SC103C PRECAST CONCRETE TECHNOLOGY**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC103C.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC103C.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC103C.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC103C.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC103C** | | **1** | **1** | **1** | **1** | **1** |

## P20SC104A BEHAVIOUR OF CONCRETE

**Class:**M.Tech. I – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: hydration process of cement and microstructure of concrete*
*LO2: the effects of concrete strength and durability*
*LO3: methods of mix design and review on special concretes*
*LO4: non-destructive testing methods of concrete and challenges towards sustainability*

## UNIT-I (9)

**Hydration of Portland Cements:** Mechanism of hydration, hydration of aluminates, hydration of silicates, aspects of setting and hardening, effect of cement characteristics on strength and heat of hydration

**Microstructure of Concrete:** Microstructure of concrete, structure of aggregate phase, structure of hardened cement paste, structure and property relationships in hydrated cement paste, transition zone in concrete and its influence on properties of concrete

## UNIT-II (9)

**Strength:** Water/Cement ratio, strength - porosity relationship, influence of aggregates, compressive strength and factors affecting, behaviour of concrete under different stresses, bond strength

**Durability of Concrete:**Factors affecting durability, physical and chemical mechanisms, transport of fluids in concrete – permeability, diffusion, absorption, carbonation, acid attacks, principles of performance-based approach

## UNIT-III (9)

**Engineered Concrete Mix design:** Significance and objectives, considerations and principles of concrete mix design, proportioning and procedures in mix design, mix design of concrete guidelines of BIS, ACI methods and British standards

**Special Concretes:** Concretes having reduced environmental impact, high performance concretes, fiber reinforced concrete, self-compacting concrete, geopolymer concrete, self-healing concrete, self-curing concrete

## UNIT-IV (9)

**Non Destructive Testing:**Surface hardness methods, Pull-out tests, Stress wave propagation methods, Electromagnetic methods, Tomography of reinforced concrete, SEM analysis

**Future Challenges:** Future demand of concrete - advantages of concrete structures, environmental considerations, concrete durability and sustainability, technology for sustainable development

**Text Books:**


[1] Mehta P.K and Monteiro Paulo,*Concrete: Microstructure, Properties and Materials*, 4th ed. New Delhi: Tata McGraw Hill Education Pvt. Ltd., 2014.*(Chapters 2,3,5,6,7,9,11 and 14)*

[2] A.M.Neville, *Properties of concrete,* 5th ed., India: Pearson Education, Dorling Kindersley India Pvt. Ltd., 2013. *(Chapters 1, 6, 10, 12 and 14)*


**Reference Books:**


[1] M.L. Ghambir, *Concrete Technology*, 5th ed. New Delhi: Tata McGraw Hill Publishers, 2016.

[2] Santha Kumar A.R, *Concrete Technology,* 2nd ed., New Delhi: Oxford University Press, 2018.

[3] RILEM TC 230,*Performance-Based Specifications and Control of Concrete Durability-State of Art Report,* 1st ed.Netherlands:Springer, 2016.

[4] BIS, IS: 10262: 2019, *Concrete Mix Proportioning Guidelines,* 2nd revision, New Delhi: Bureau of Indian Standards, 2019.

[5] ACI 211 Committee. *Guide for Selecting Proportions for No-Slump Concrete Vol. II, Reported* by ACI Committee 211: American Concrete Institute, 2002.

[6] B. S. 8110*, The Structural Use of Concrete,* British Standard Institution, 1997.

[7] BIS, IS 456: 2000*, Plain and Reinforced Concrete- Code of Practice,* 5th revision, New Delhi: Bureau of Indian Standards, 2019.


**Course Learning Outcomes (Cos):**

On completion of this course, students will be able to...

*CO1: apprehend the chemistry of hydration in cement and concrete microstructure*
*CO2: estimate the strength and durability of concrete*
*CO3: develop concrete mixes and comprehend special concretes*
*CO4: evaluate concrete using NDT methods and assess sustainable challenges in concrete*

| **Course Articulation Matrix(CAM): P20SC104A BEHAVIOUR OF CONCRETE** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC104A.1** | 2 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC104A.2** | 2 | 1 | 1 | 2 | 1 |
| CO3 | **P20SC104A.3** | 2 | 1 | 1 | 2 | 1 |
| CO4 | **P20SC104A.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC104 A** | | **1.75** | **1** | **1** | **1.5** | **1** |

## P20SC104B CONSTRUCTION PROJECT ADMINISTRATION

**Class:**M.Tech. I – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Exam: | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: organization of a project and contracting for public projects*
*LO2: responsibilities of project representative*
*LO3: handling and documentation of a project*
*LO4: preconstruction operations and electronic project management*

## UNIT – I (9)

**Project Delivery System:** Project participants, construction administration, organizational structure of a construction project, professional and engineering definition of construction management

**Design-Build Concept:** Design–build contracts, definitions of individual construction responsibilities, scope of work in a construction management contract, responsibility for coordination of the trades, partnering concept, contracting for public works projects, construction administration task list

## UNIT – II (9)

**Responsibility and Authority:** Role of resident project representatives, lines of authority on construction projects, authority and responsibility of the resident project representative

**Resident Project Representative Office Responsibilities:** Setting up a field office, familiarization with construction documents, equipping the field office, establishment of communications

## UNIT – III (9)

**Managing Project:** Handling job-related information, staffing responsibilities, Field Cost Indexes (FCI), selection of trailer-type field offices, development of an inspection plan

**Project Documentation:** Records and reports, Project documentation as evidence in claims, files and records, construction reports, construction diary, daily reports, intermittent inspection, contractor submittals

## UNIT – IV (9)

**Preconstruction Operations:** Description of approach, constructability analysis, issuance of bidding documents, pre-qualification of bidders, opening, acceptance and documentation of bids, development of quality control programme, filed office organization, preconstruction conference

**Electronic Project Administration**: Computer usage in project administration, web enabled project management applications, Building Information Modeling (BIM), synchronization of multiple devices

**Text Books:**

[1] Edward R. Fisk and Wayne D. Reynolds, *Construction Project Administration,* 10th ed. New York: Pearson,2016. *(Chapter 1-5 and 12)*

**Reference Books:**

[1] James E. Koch and Douglas D. Gransberg, Keith R. Molenaar,*Project Administration for Design-BuildContracts,*USA:ASCE press, 2010.

[2] Kumar Neeraj Jha, *Construction Project Management,* 2nd ed.New Delhi: Pearson, 2015.

**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: create organization and propose contracts for a project*
*CO2: list responsibilities for project representatives*
*CO3: appraise aspects of handling a project and develop project documentation*
*CO4: execute preconstruction activities and adapt electronic project administration*

| **Course Articulation Matrix (CAM): P20SC104B CONSTRUCTION PROJECT ADMINISTRATION** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC104B.1** | 1 | 1 | 1 | - | 1 |
| CO2 | **P20SC104B.2** | 1 | 1 | 1 | - | 1 |
| CO3 | **P20SC104B.3** | 1 | 1 | 1 | - | 1 |
| CO4 | **P20SC104B.4** | 1 | 1 | 1 | - | 1 |
| **P20SC104B** | | **1** | **1** | **1** | **-** | **1** |

## P20SC104C BUILDING SERVICES

**Class:**M.Tech. I – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Exam | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: building services and firefighting systems*
*LO2: building transport systems and water supply systems*
*LO3: electrical and air conditioning services*
*LO4: disposal and miscellaneous building services*

## UNIT –I (9)

**Elements of Building Services:** Basic needs for human comfort, comfort equation, type of services required to keep facility usable, control rules, general building requirements – NBC recommendations, role and administrative functions of supervisors, functional planning in building

**Fire Fighting:** Basic requirement of the works for fighting system, various components of the firefighting system, firefighting installations in high-rise buildings, commercial/industrial complexes, smoke, fire and heat detectors, checklist for fire safety

## UNIT –II (9)

**Lifts/Elevators, Escalators:** Legal formalities for elevators, Various types of lifts, working mechanisms of lift and escalators, estimate the number of lifts required, Indian standard codes for planning & installations of elevator, inspection & maintenance of lifts

**Water Supply System:** Water supply and distribution system in high-rise building & other complexes, hot water and cold-water services, joints on water pipes, backflow protection, pumps and pumping mechanisms, do's &don'ts for water pipe networks

## UNIT –III (9)

**Electrical Services:** Electricity distribution, Basics of single phase & three phase electrification, electrical network & appliances, earthling systems and bonding, power and lighting circuits, overload protection, Indian standard codes for electrical appliances, wiring operations - maintenance of network & appliances

**Air-Conditioning and Heating:** Air conditioning – principles and applications, centralised systems, air temperature profile, packaged air conditioning systems, heat

emitters, combined heat and power, steam heating systems, timed control of heating systems, HVAC

## UNIT –IV (9)

**Disposal Services:** Combined and separate drainage systems, rodding point system, sewer connection, drain laying and drainage ventilation, drainage design principles, bedding of drains, joints, subsoil drainage, cesspools and septic tanks, waste and refuse processing

**Miscellaneous Services:** Gas installation – connection of gas supply, burner types, security installations – intruder alarms, micro switch and magnetic read, acoustics, vibration and inertia detectors, land scaping &horticulture

**Text Books:**


[1] Fred Hall and Roger Greeno, *Building Services Handbook,* 9th ed. London:Taylor & Francis (U.K.) Ltd., 2017. *(Chapters 1,2 and 5-12)*

[2] E. F. Curd and C. A. Coward, *Introduction to building Services*, 2nd ed. Basingstoke: Palgrave MacMillan Press (U.K.)Ltd.,1996. *(Chapters 1-3 and 5-8)*


**Reference Books:**


[1] IVOR H. Seeley, *Building Technology*, 5th ed. Basingstoke: Palgrave MacMillan Press (U.K.) Ltd.,1995.

[2] R. Chudley, *Building Finishes, fittings and domestic service,* 2nd ed., Harlow: Pearson Education (U.K.) Ltd., Longman Scientific and Technical book, 1988

[3] David V. Cheddarton, *Building Services Engineering*, 6th ed. London: Taylor & Francis (U.K.) Ltd., 2004.

[4] National Building Code of India 2016.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: appraise building services and the firefighting requirements*
*CO2: recommend building transport and water supply systems*
*CO3: choose suitable electrical and air conditioning services for building*
*CO4: plan the disposal system and choose miscellaneous services*

| **Course Articulation Matrix (CAM): P20SC104C BUILDING SERVICES** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC104C.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC104C.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC104C.3** | 1 | 1 | 1 | - | 1 |
| CO4 | **P20SC104C.4** | 1 | 1 | 1 | - | 1 |
| **P20SC104C** | | **1** | **1** | **1** | **1** | **1** |

## P20SC105STRUCTURAL ENGINEERING LABORATORY

**Class:**M.Tech. I-Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 4 | 2 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
*LO1: effect of water cement ratio, aggregate ratio, shape and sizeon strength of concrete*
*LO2: qualitative measure of concrete*
*LO3: moment-curvature, stress - strain behaviour of concrete*
*LO4: shear, temperature and bond in concrete*

### LIST OF EXPERIMENTS

1. Analyze the effect of water/cement ratio on strength of concrete.
2. Investigate the fine aggregate/coarse aggregate ratio on strength of concrete.
3. Explore the correlation between cube strength and cylinder strength.
4. Determine the concrete mix design using ACI method.
5. Investigate the Non-Destructive testing of concrete.
6. Explore the effect of pozzolanic materials on strength of concrete.
7. Analyze the Moment-curvature behaviour of under reinforced beams.
8. Analyze the Moment-curvature behaviour of over reinforced beams.
9. Examine the effect of pure shear on concrete.
10. Explore the effect of size on concrete.
11. Determine the effect of temperature on strength of concrete.
12. Assessment of bond strength between steel and concrete.

**Laboratory manual:**

[1] *Structural Engineering Laboratory Manual,* Prepared by faculty of Civil Engineering Department, KITSW.

**Reference Books:**

[1] Neville A.M, *Properties of Concrete*, 4th ed. Longman, United Kingdom: English Language, Book society,2015.

[2] M. S. Shetty, *Concrete Technology (Theory and Practice)*,7th ed. New Delhi: S. Chand Company, 2016.
[3] N. Krishna Raju, *Concrete Mix Design*, 5th ed. CBS Publishers and Distributors, 2018.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: assess the effect of water cement ratio, aggregate ratio, shape and sizeon strength of concrete*
*CO2: evaluate the quality of concrete*
*CO3: develop the moment-curvature, stress-strain behavior of concrete*
*CO4: intervene the shear, temperature and bond in concrete*

| **Course Articulation Matrix (CAM): P20SC105 STRUCTURAL ENGINEERING LABORATORY** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC105.1** | 2 | 2 | 1 | 1 | 1 |
| CO2 | **P20SC105.2** | 2 | 2 | 1 | 1 | - |
| CO3 | **P20SC105.3** | 2 | 2 | 1 | 1 | 1 |
| CO4 | **P20SC105.4** | 2 | 2 | 1 | 1 | - |
| **P20SC105** | | **2** | **2** | **1** | **1** | **1** |

## P20SC106 CONSTRUCTION PLANNING AND SCHEDULING LABORATORY

**Class:**M.Tech. I – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 2 | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: creating project plan*
*LO2: time estimates and allocation of resources*
*LO3: critical path and baseline plan*
*LO4: updating projects and generating reports*

### LIST OF EXPERIMENTS

1. Using MS Projects/Primavera create and define a new Project Plan, configure a Project Calendar
2. Develop a Work Breakdown Structure (WBS)
3. Develop a Gantt Chart by adding tasks, durations and predecessors
4. Define dependencies and time estimates
5. Define resources and allocate them to activities
6. Critical Path Analysis
7. Perform Crashing, Tracking and Resource Smoothening & levelling
8. Perform Resource optimization
9. Project tracking and updating actuals
10. Generate tables and reports

**Laboratory manual:**

[1] *Construction Planning and Scheduling Laboratory Manual,* prepared by faculty of Civil EngineeringDepartment, KITSW.

**Reference Books:**

[1] K. N. Jha, *Construction Project Management*, 3rd ed. Noida: Pearson India Publications, 2016.
[2] Carl Chatfield and Johnson, *Microsoft Project 2016 Step by Step*,USA: Microsoft Press, 2016.
[3] Dennis Lock, *Project Management in Construction*, 1st ed. USA: Gower Publications Ltd., 2004.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: create a new project plan*
*CO2: interpret resources in the project*
*CO3: monitor the project progress*
*CO4: develop project progress reports for tracking and updating*

| **Course Articulation Matrix (CAM): P20SC106CONSTRUCTION PLANNING AND SCHEDULING LABORATORY** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PS02** |
| CO1 | **P20SC106.1** | 1 | 2 | 1 | - | 1 |
| CO2 | **P20SC106.2** | 1 | 2 | 1 | - | 1 |
| CO3 | **P20SC106.3** | 1 | 2 | 1 | - | 1 |
| CO4 | **P20SC106.4** | 1 | 2 | 1 | - | 1 |
| **P20SC106** | | **1** | **2** | **1** | **-** | **1** |

## P20MC107RESEARCH METHODOLOGY AND IPR

**Class:**M. Tech., I-Semester**Specialization(s):**SCE, DE, VE, PE, SE
DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students' knowledge in/on…
*LO1: research methodology, approaches, principles of experimental design and research plan*
*LO2: sampling design, data collection, data representation and statistical analysis*
*LO3: layout of a research report, technical paper writing, oral presentation and intellectual property*
*LO4: patent rights and developments in IPR*

### UNIT-I (6)

**Research Methodology:** Meaning of research, objectives,motivation, types, approaches, research methods Vs methodology, scientific method, research process, criteria for good research, literature review, research ethics, plagiarism, problems encountered by researchers in India

**Defining the Research Problem and Research Design**: Selecting a research problem, Necessity and techniques in defining research problem, need for research design, features of good design, different research designs, basic principles of experimental design, developing a research plan

### UNIT – II (6)

**Sampling Design**: Census and sample survey, implications, steps, criteria of selecting a sampling procedure, characteristics of a good sample design, types of sample designs, complex random sampling designs

**Data Collection & Data Analysis:** Collection of primary and secondary data, observation method, interview method, collection of data through questionnaires, schedules, data organization, methods of data grouping, diagrammatic and graphic representation of data, regression modeling, direct and interaction effects, ANOVA, F-test, time series analysis, autocorrelation and autoregressive modeling

### UNIT – III (6)

**Interpretation and Report Writing:** Interpretation technique, precaution in interpretation, significance, steps and layout of report writing, types of reports, oral presentation, mechanics of writing a research report, precautions, format of the research report, synopsis, dissertation, thesis, references/bibliography/webliography, technical paper writing/ journal/ report writing, making presentation, use of visual aids

**Nature of Intellectual Property:** Patents, designs, trade and copyright

**Process of Patenting and Development:** Technological research, innovation, patenting, development

## UNIT – IV (6)

**Patent Rights:** Scope of patent rights, licensing and transfer of technology, patent information and databases, geographical indications

**New Developments in IPR:** Administration of patent system, new developments in IPR, IPR of biological systems, computer software etc., traditional knowledge case studies, IPR and IITs

**Text Books:**


[1] C.R Kothari and Gaurav Garg, *Research Methodology, Methods & Techniques*, 4th ed.New Age International Publishers, 2019.(*Chapters 1, 2, 3, 6, 7, 11, 14*)

[2] Deborah Ebouchoux, *Intellectual Property, The Law of Trademarks, Copyrights, Patents and Secrets,* 4th ed. Delmar, Cengage Learning, 2012.*(Chapter 1, 2, 3, 17, 18)*

[3] ***Anti-plagiarism policy of KITSW*** - A handout prepared by Dean, Research and Development, KITSW, Jan 2020.

[4] Frequently Asked Questions, Office of CGPDTM, INDIA 2020

[5] Patent Office Procedures: http://www.ipindia.nic.in/writereaddata/images/pdf/ patent-office-procedures.pdf


**References Books:**


[1] Stuart Melville and Wayne Goddard, *Research methodology: An Introduction for Science & Engineering Students* 2nd ed. JUTA, 2007.

[2] Robert P. Merges, Peter S. Menell, Mark A. Lemley, *Intellectual Property in New Technological Age - I*, Clause 8, 2016.

[3] Dobera J Halbert, *Resisting Intellectual Property*, Taylor & Francis Ltd.,1sted.2005.

[4] Ranjit Kumar, *Research Methodology: A Step by Step Guide for beginners*, 3rd ed.New Delhi: Sage Publications India Pvt. Ltd, , 2011.

[5] T. Ramappa, *Intellectual Property Rights Under WTO,* 4th ed. S. Chand, 2008

[6] R. Ganesan, *Research Methodology for Engineers,* MJP Publishers, Chennai, 2011

[7] Patent application procedures: https://patentinindia.com/cost-patent-registration-india/

[8] http://www.ipindia.nic.in/history-of-indian-patent-system.htm

[9] Patent Law India: https://www.mondaq.com/india/patent/656402/patents-law-in-india--everything-you-must-know

[10] How to file patents: https://iptse.com/how-to-file-patents-understanding-the-patent-process-in-india/

[11] How Can I get a patent for my project:https://patentinindia.com/cost-patent-registration-india/

**Course Learning Outcomes (COs)**:
On completion of this course, students will be able to…

*CO1: develop and formulate research problem using research methodology techniques*
*CO2: utilize techniques of data modeling and analysis to solve research problem*
*CO3: choose an appropriate methodology to write a technical report and present a research paper*
*CO4: judge patent rights and adapt new developments in IPR for their patent publications*

| **Course Articulation Matrix (CAM): P20MC107 RESEARCH METHODOLOGY & IPR** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO 1** | **PSO 2** |
| CO1 | **P20MC107.1** | 2 | 2 | 1 | - | - |
| CO2 | **P20MC107.2** | 2 | 2 | 1 | - | - |
| CO3 | **P20MC107.3** | 2 | 2 | 1 | - | - |
| CO4 | **P20MC107.4** | 2 | 2 | - | - | - |
| **P20MC107** | | **2** | **2** | **1** | **-** | **-** |

## P20AC108A ENGLISH FOR RESEARCH PAPER WRITING

**Class:** M.Tech. I-Semester

**Specialization(s):** SCE, DE, VE, PE, SE DS, DC &CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**

This course will develop students' knowledge in /on…

*LO1: planning for quality research writing with improved level of readability*

*LO2: constituents and attributes of a research paper*

*LO3: specifications for research transcription and pedagogic skills for reporting research*

*LO4: guidelines for publishing research papers in quality journals*

### UNIT-I (6)

**Skills for Research Writing:** Planning and preparation, word order, breaking up long sentences, structuring paragraphs and sentences, being concise and removing redundancy

**Improving Level of Readability:** Avoiding ambiguity and vagueness,clarifying who did what, highlighting your findings, hedging and criticizing, paraphrasing and plagiarism

### UNIT-II (6)

**Constituents of a Research Paper:** Abstract, Styles of abstract, keywords, characteristics of poor abstract, assessing quality of abstract, introduction- outline in introduction, assessing quality of introduction, review of literature, ways of referring to authors in literature

**Attributes of a Research paper:** Methodology, use of tenses and articles in methodology, results, results, styles of reporting results, discussion, styles of writing discussions, conclusions, impact of writing conclusions, assessing quality of conclusions, final check-do's and don'ts

### UNIT-III (6)

**Specifications for Research Transcription:** Structuring phrasing and summarizing oftitle and abstract, structuring phrasing and summarizing of introduction, critical

review of literature, limitations of previous work and demonstration of innovation in proposed research

**Pedagogic Skills for Reporting Research:** Structuring and justifying the methodology, structuring, reporting, interpreting and summarizing results, structuring, comparing, interpreting and summarizing discussions, styles of writing discussions, structuring, differentiating and summarizing of conclusions

## UNIT-IV (6)

**Quality Assurance and Corroboration of Research:** Indexing and harnessing useful phrases**,** adapting final check for readability, clarity in logical order of argumentation, checking for journal guidelines, consistency, accuracy, acknowledgements and spell-check

**Text Books:**

[1] Adrian Wallwork, *English for Writing Research Papers*, 2nd ed.New York: Dordrecht Heidelberg London, Springer books, 2016.

**Reference Books**:

[1] Goldbort R, *Writing for Science, London*, 2nded. Yale University Press, 2006.

[2] Day R, "How to Write and Publish a Scientific Paper", 8th ed, Cambridge University Press, 2016.

[3] Adrian Wallwork,*English for Academic Research*, 2nd ed. New York: Grammar, Usage and Style, Springer Dordrecht Heidelberg London, Springer Books ,2012.

**Course Learning Outcomes (Cos):**

On completion of this course, the student will be able to…

***CO1****: develop essential skills for research writing with improved level of readability*

***CO2****: organize the constituents of research paper and derive conclusions with a final check of Do's and Don'ts*

***CO3****: justify, interpret, compare and summarize results for proposed methodologies in research paper*

***CO4****: adopt quality assurance methods like final check for readability, consistency and accuracy of a research paper*

**Course Articulation Matrix (CAM): P20AC108AENGLISH FOR RESEARCH PAPER WRITING**

| CO Code | | PO 1 | PO 2 | PO 3 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|
| CO1 | **P20AC108A .1** | 1 | 2 | 2 | - | - |
| CO2 | **P20AC108A .2** | 1 | 2 | 2 | - | - |
| CO3 | **P20AC108A .3** | 1 | 2 | 2 | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| CO4 | **P20AC108A .4** | 1 | 2 | 2 | - | - |
| **P20AC108A** | | 1 | 2 | 2 | - | - |

## P20AC108B SANSKRIT FOR TECHNICAL KNOWLEDGE

**Class:**M.Tech. I – Semester**Specialization(s):** SCE, DE, VE, PE,SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students' knowledge in/on…
*LO1:proficiency in illustrious sanskrit, the scientific language in the world*
*LO2: the depth of grammar in sanskrit*
*LO3: deeper insight into tenses used in sanskrit*
*LO4: concepts related to various technical fields*

### UNIT – I (6)

**Introduction:**Alphabets, vowels,consonants, mahesvara sutras,combined alphabets,verbs, basic words

### UNIT –II (6)

**Study of Grammar I:** Singular/dual/plural,nominative case,accusative case,instrumental case,dative case, ablative case,genitive case, locative case

### UNIT– III (6)

**Study of Grammar II:** Nouns and adjectives,indeclinable,present tense,past tense, future tense, order and request, prefixes, number word, combinations ablative case, genitive case, locative case and cases

### UNIT - IV (6)

**Technical ConceptsRelated to Various Fields**: Technical concepts of mathematics, chemistry, electrical science, mechanics &mechanical science, metallurgy, aeronautics, marine science, measurement of time, astronomy, architecture, botany, agriculture, hygiene &health

**Text Books:**

[1] Dr.Vishwas, *Abhyaspustakam,* 1st ed. New Delhi: Samskrita-Bharti Publication, 2014.
[2] Suresh Soni, *India's Glorious Scientific Tradition*, 1st ed. NewDelhi: Ocean books (P) Ltd, 2008(Unit IV).

**Reference Books:**

[1] VempatiKutumbshastri, *Teach Yourself Sanskrit*, 1st ed. New Delhi: Prathama DeekshaRashtriya Sanskrit Sansthanam, 2012.

**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: understand to read and write basic Sanskrit language*
*CO2: identify the usage of grammar in the ancient Indian language*
*CO3: make use of tenses in Sanskrit language*
*CO4: analyze the ancient Sanskrit literature on Science and Technology*

**Course Articulation Matrix (CAM): P20AC108B SANSKRIT FOR TECHNICAL KNOWLEDGE**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20AC108B.1** | 2 | 1 | 1 | - | - |
| CO2 | **P20AC108B.2** | 2 | 1 | 1 | - | - |
| CO3 | **P20AC108B.3** | 2 | 1 | 1 | - | - |
| CO4 | **P20AC108B.4** | 2 | 1 | 1 | - | - |
| **P20AC108B** | | **2** | **1** | **1** | **-** | **-** |

## P20AC108C CONSTITUTION OF INDIA

**Class:** M. Tech. I – Semester

**Specialization(s)**: SCE, DE, VE, PE,SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**

This course will develop students 'knowledge in/on…

*LO1:state policy and parliamentary form of government, council of ministers*

*LO2: necessity of act of information technology and its powers, cyber security and its laws*

*LO3: consumer protection act, rights of consumer-deficiency in service*

*LO4: crimes against women, different legislations, process of investigation and right to information act*

### UNIT – I (6)

**Constitutional Law:**Constitution meaning and significance-constitutional history-status of fundamental rights-role of fundamental duties-implementation of the directive principles of the state policy-parliamentary form of government-president-prime minister-council of ministers-federal structure in constitution-relations between central and state-amendment of constitution –procedure and kinds of amendments

### UNIT –II (6)

**Law of Information Technology:** Evolution-genesis and necessity of information technology act-features and various authorities under it act-their powers-impact of other related enactments-e-commerce laws in India-digital and electronic signatures in Indian laws-e-contracts and its validity in India-cyber tribunals-definition and necessity of cyber security-computer and cyber security-e-mail security-database security-operating system security-advance computers-network and mobile security techniques-sensitive personal data and information in cyber laws-cybercrimes-hacking-phishing – stalking-cyber terrorism

### UNIT– III (6)

**Corporate Law:** Definition and essentials of valid contract - corporate incorporation and management-directors of company-company secretary-corporate governors-different system of corporate governors-corporate governance and social responsibility-emerging trends-corporate and social environment responsibility-competition law-objectives competition commission of India-consumer protection act-consumerism-rights of consumer-deficiency in service-unfair trade practices-e-contracts etc.

## UNIT - IV (6)

**Criminal Law:** Definition of crime--crimes against women including cybercrimes-criminal justice systems-protection for women for atrocities-different legislations like constitution, Indian penal code, human rights, domestic violence, equality in rights, dowry prohibition, prevention of child marriage, prevention of sexual harassment against woman at work place, protection of children some sexual harassment – investigation – compliant - process of investigation – fir, panchanama, closure report, charge sheet etc., - procedure of search

**Right to Information Act:** Freedom of information - Indian constitution and right to information - legislating the right to information - salient features of the right to information act 2005 - public authority under RTI act - nature of RTI, exemptions and limitations - composition, powers and functions of the information commissions - right to information and implementation issues

**Text Books:**


[1] M.P.Jain, Indian *Constitutional Law*, Vol.1, Wadhwa & Co, Nagpur, 2003

[2] Vakul Sharma, *Information Technology – Law and Practice,* 3rded.Universal Law Publishing, 2011.

[3] Gower and Davies, *Principles of Modern Company Law,* 10th ed.Sweet and Maxwell Publishing,

[4] Ratan Lal and Dhiraj Lal: *Indian Penal Code*, 36th ed. Wadhwa & Co., 2000.

[5] O.P.Srivastava: *Principles of Criminal Law,* 6th ed. Eastern Book Company, 2016.

[6] KM Shrivastava, *The Right to Information: A Global Perspective*, New Delhi:Lancer Publisher, 2013.


**Reference Books:**


[1] H.M.Seervai, *Constitutional Law of India, Vol.3,*4th ed. N.M.Tripathi ,. 1997.

[2] G.C.V.Subba Rao, *Indian Constitutional Law*, Hyderabad : S.Gogia& Co.

[3] Dr.S.R.Myneni, *Information Technology Law (Cyber Laws),* 1st ed., Hyderabad: Asia Law House 2018.

[4] J.M. Thomson: *Palmer's Company Law,* Vol.4, 21sted. Wildy& Sons Ltd.

[5] P.S.Achutan Pillai: *PSA Pillai'sCriminal Law*, Butterworth Co., 2000.

[6] K.D.Gour: *Criminal Law*, *Cases and Materials*, 9th ed. LexisNexis, 2019.

[7] Sairam Bhat, *Right to Informationand Good Governance*, National Law School of India University, 2016.

[8] Dheera Khandelwal and KK Khandelwal, A Commentary and Digest on the *Right to Information Act: 2005,* 2nd ed.2014.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: develop the knowledge in state policy and parliamentary form of government*
*CO2: make use of information technology act and cyber security*
*CO3: utilize the consumer protection act and rights consumer*
*CO4: perceive the legislations and understand the process of investigation and right to information act*

| **Course Articulation Matrix (CAM): P20AC108CCONSTITUTION OF INDIA** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20AC108C.1** | 1 | 1 | 1 | - | - |
| CO2 | **P20AC108C.2** | 1 | 1 | 1 | - | - |
| CO3 | **P20AC108C.3** | 1 | 1 | 1 | - | - |
| CO4 | **P20AC108C.4** | 1 | 1 | 1 | - | - |
| **P20AC108B** | | **1** | **1** | **1** | **-** | **-** |

## P20AC108DPEDAGOGY STUDIES

**Class:**M.Tech. I – Semester**Specialization(s):** SCE, DE, VE, PE,SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students' knowledge in/on…
*LO1:terminology of pedagogy studies, role of curriculum, relation between teaching and learning*
*LO2: effectiveness of pedagogical practices and teaching strategies*
*LO3: student centered approaches of learning*
*LO4: factors supporting effective pedagogy, research gaps and future directions of potential areas*

### UNIT-I (6)

**Methodology:** Aims and rationale, Policy background, conceptual framework and terminology, theories of learning- behaviourism, constructivism, social constructivism, critical theory, difference between curriculum and syllabus, curriculum, importance of curriculum for students and teachers, role played by the curriculum
**Teaching- Learning Process:** Introduction, concept of pedagogy, principles of teaching, maxims of teaching, phases of learning, relationship between teaching and learning, factors of teaching and learning in classroom situation, difference between teaching and learning

### UNIT-II (6)

**Overview of Pedagogical Practices in Developing Countries:**Overview and aims, pedagogy approaches, pedagogy as practice, pedagogy as ideas, pedagogy and equity, curriculum, teacher education - initial teacher education, continuing professional development, training unqualified teachers,**e**ffectiveness of pedagogical practices, pedagogic theory and pedagogical strategies, teachers' attitudes and beliefs
**Strategies of Teaching:** Features, characteristics, advantages and limitations of lecture method, demonstration method, experimental method and discussion method

### UNIT-III (6)

**Student Centred Approaches:** Features, characteristics, advantages and limitations of constructivist approach of learning, Discovery method of learning, Enquiry method, Project Based Learning (PBL), Activity Based Learning (ABL)
**Practical Approaches:** Features of experiential learning and Teacher's role, Peer tutoring, Field visits and process of organizing, E-learning tools, strengths and weaknesses

## UNIT-IV (6)

**Role of Teacher Education, School Curriculum, Guidance Materials in Supporting Effective Pedagogy:**Professional development, alignment with classroom practices and follow-up support, peer support, support from the head teacher and the community, curriculum and assessment, barriers to learning:limited resources and large class sizes

**Research gaps and future directions:** Research design, contexts, pedagogy, teacher education, curriculum and assessment, dissemination and research impact

**Textbooks:**


[1] Dr. S. K. Bhatia, Dr. Sonia Jindal, *A Textbook of curriculum, pedagogy and evaluation*, 1st ed. New Delhi: Paragon International Publishers, 2016.

[2] Jo Westbrook, NaureenDurrani, Rhona Brown, David Orr, John Pryor, Janet Boddy, Francesca Salvi, *Pedagogy, Curriculum. Teaching Practices and Teacher Education in Developing Countries*, Education Rigorous Literature Review, Center for International Education, University of Sussex, December 2013.


**Reference books:**


[1] Ackers J, Hardman F, *Classroom interaction in Kenyan primary schools*, Compare, 31 (2): 245-261, 2001.

[2] Agrawal M, *Curricular reform in schools: The importance of evaluation*, Journal of Curriculum Studies, 36 (3): 361-379, 2004.

[3] Akyeampong K, *Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1.* London: DFID, 2003.

[4] Akyeampong K, Lussier K, Pryor J, Westbrook J, *Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?* International Journal Educational Development, 33 (3): 272–282, 2013.

[5] Alexander RJ, *Culture and pedagogy: International comparisons in primary education.* Oxford and Boston: Blackwell, 2001.

[6] Chavan M, *Read India: A mass scale, rapid, 'learning to read' campaign,* 2003.

[7] www.pratham.org/images/resource%20working%20paper%202.pdf.


**Course Learning Outcomes (COs)**:
On completion of this course, the students will be able to…

*CO1: describe the significance of curriculum, relationship between teaching and learning*

*CO2: justify the effectiveness of pedagogical practicesof teaching and compare the lecture, demonstration, experimental and discussion methods of teaching strategies*

*CO3: analyse the role of student centered approaches in learning of a student and identify suitable approaches for the improvement*

*CO4: exemplify the role of professional development, curriculum, assessment for effective pedagogy and identify the research gaps in allied areas*

| Course Articulation Matrix (CAM): P20AC108D PEDAGOGY STUDIES | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO 1** | **PSO 2** |
| CO1 | **P20AC108D.1** | - | 1 | - | - | - |
| CO2 | **P20AC108D.2** | 1 | 1 | 1 | - | - |
| CO3 | **P20AC108D.3** | 1 | 1 | 1 | - | - |
| CO4 | **P20AC108D.4** | 1 | 1 | 1 | - | - |
| **P20AC108D** | | **1** | **1** | **1** | **-** | **-** |

**DEPARTMENT OF CIVIL ENGINEERING**
**KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15**
*(An Autonomous Institute under Kakatiya University, Warangal)*
**SCHEME OF INSTRUCTION & EVALUATION OF**
## M.TECH. (STRUCTURAL AND CONSTRUCTION ENGINEERING)

**PRR-20**

### SEMESTER-II

| Sr. No. | Course Type | Course Code | Course Name | Teaching scheme | | | Credits | Evaluation Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIE - TA | | | | | | | ESE | Total Marks |
| | | | | | | | | I²RE | | | | Minor | MSE | Total | | |
| | | | | L | T | P | | ATLP | CRP | CP | PPT | | | | | |
| 1 | PC | P20SC201 | Dynamics of Structures | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 2 | PC | P20SC202 | Construction Techniques & Equipment | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 3 | PE | P20SC203 | Professional Elective-III/ MOOC-III | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 4 | PE | P20SC204 | Professional Elective-IV/ MOOC-IV | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 5 | PC | P20SC205 | Structural Engineering Software Applications Laboratory | - | - | 4 | 2 | - | - | - | - | - | - | 60 | 40 | 100 |
| 6 | PC | P20SC206 | Infrastructure Design and Drawing laboratory | - | - | 4 | 2 | - | - | - | - | - | - | 60 | 40 | 100 |
| 7 | PROJ | P20SC207 | Mini Project with Seminar | - | - | 4 | 2 | - | - | - | - | - | - | 100 | - | 100 |
| 8 | AC | P20AC208 | Audit Course-II | 2 | - | - | 1 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| | | | Total: | 14 | - | 12 | 19 | | | | | | | 520 | 280 | 800 |

**[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]**

**Elective- 3**

P20SC203A: Earthquake Resistant Design of RCC Structures
P20SC203B: Design of Special Structures
P20SC203C: Repair, Rehabilitation and Retrofitting of structures
P20SC203D: MOOCs

**Elective- 4**

P20SC204A: Quality and Safety Management
P20SC204B: Sustainable Construction Engineering
P20SC204C: Urban Infrastructure Planning and Management
P20SC204D: MOOCs

**Audit Course - 2**

P20AC208A: Stress Management by Yoga
P20AC208B: Value Education
P20AC208C: Personality Development through Life Enlightenment Skills
P20AC208D: Disaster Management

**Total Contact Periods/Week: 26** **Total Credits: 19**

## P20SC201DYNAMICS OF STRUCTURES

**Class:**M.Tech. II – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Exam | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: fundamentals of dynamic loading*
*LO2: dynamic and earthquake response of single degree of freedom system*
*LO3: multi degree of freedom system, free vibrations of structures*
*LO4: dynamic and earthquake analysis of linear systems*

### UNIT–I (9)

**Concepts of Structural Dynamics:** Fundamental objective of structural dynamics analysis, types of prescribed loadings,methods of discretization, formulation of the equations of motion

**Single Degree-of-Freedom System:** Equations of motion, analysis of free vibration, response to harmonic and periodic loadings, response to impulse loading, response to general dynamic loading: step by step method, generalized single degree freedom systems

### UNIT–II (9)

**Numerical Evaluation of Dynamic Response:** Time stepping methods, central difference method, Newmark's method

**Earthquake Response of SDOF Systems:** Earthquake excitation, response quantities and history, response spectrum concept and characteristics, elastic design spectrum, comparison of design and response spectra

### UNIT–III (9)

**Multi Degree of Freedom System:** Equations of motion, Static condensation, symmetric and unsymmetric plan systems: ground motion, in-elastic systems

**Free Vibration of MDOF Systems**: Natural vibration frequency and modes, free vibration response, computation of vibration properties, undamped free vibrations, analysis of vibration frequencies, free vibration analysis of systems with damping

## UNIT-IV (9)

**Dynamic Analysis of Linear Systems:** Two degree of freedom systems, model analysis, model response contribution, Static correction method, analysis of non-classically damped systems, relation between time and frequency

**Earthquake Analysis of Linear Systems:** Model analysis, Response spectrum analysis, static condensation, Rayleigh ritz method, Time stepping method, analysis of nonlinear systems

**Text Books:**

[1] K. Chopra, *Dynamics of Structures: Theory & Applications to Earthquake Engineering*, 1st ed. New Jersey: Prentice Hall Inc., 1995.

**Reference Books:**

[1] Mario Paz, *Structural Dynamics - Theory & Computations,*2nd ed. New Delhi: CBS Publishers, 2001.

[2] R.W. Clough and J. Penzien, *Dynamics of Structures*, 3rd ed. Computers and Structures Inc., 2003.

[3] BIS, IS: 1893 (part-1)-2002, *Criteria for Earthquake Resistant-Design of structures,*New Delhi: Bureau of Indian Standards.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: appraise the concepts of dynamic loading*
*CO2: evaluate the dynamic and earthquake response of single degree of freedom system*
*CO3: solve multi degree of freedom system and free vibrations of structures*
*CO4: analyze dynamic and earthquake response of linear systems*

| **Course Articulation Matrix (CAM): P20SC201DYNAMICS OF STRUCTURES** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC201.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC201.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC201.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC201.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC201** | | **1** | **1** | **1** | **1** | **1** |

## P20SC202 CONSTRUCTION TECHNIQUES & EQUIPMENTS

**Class:**M.Tech. II – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Exam | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: financing aspects, management and maintenance of construction equipment*
*LO2: earthmoving and drilling equipment*
*LO3: functions of cranes and concreting equipment*
*LO4: equipment valuation and application of artificial intelligence*

### UNIT-I (9)

**Mechanization in Construction:** Mechanization in construction industry, financing aspects of construction plants and equipment, factors effecting selection of construction equipment

**Operation and Maintenance:** Operating the construction equipment, equipment management, maintenance characteristics performance

### UNIT-II (9)

**Drilling and Plant Equipments:** Piles and pile driving equipments, drilling rock and the earth, air compressors and pumps

**Earthmoving Equipments:** Excavating and demolishing equipment - shovels, scrapers and bulldozers, compaction and stabilization equipments, trucks and hauling equipments, finishing equipments, blasting rock

### UNIT-III (9)

**Hoisting Equipment:** Hoist winch, chains, and hooks, slings, various types of cranes-tower crane, mobile crane and derrick crane, safety in crane operation

**Conveying Equipment:** Various types of belts and conveyors, concreting equipment: concrete mixers, truck mixers, pneumatic concrete placers, vibrators and scaffolding

## UNIT-IV(9)

**Equipment Valuation:** Cost and value, Purpose of valuation, value classification, depreciation of equipment-types,methods of calculating depreciation- straight line,sinking fund, declining balance, accelerated depreciation method

**Artificial Intelligence in Construction:** Artificial intelligence, expert system- need, structure, potential, potential benefits, limitations, potential system application areas in construction

**Text Books:**


[1] PeurifyR.L,*Construction, Planning, equipment and methods,* 7th ed.New Delhi: McGraw Hill Book Company, Inc., 2010. *(Chapters 1, 2, 5 -12, and 15-18)*

[2] Dr S.Seetharaman,*Construction Engineering and Management*,5th ed. New Delhi: Umesh publications, 2019. *(Chapters 18and 23 -25)*


**Reference Books:**


[1] Kumar Neeraj Jha,*Construction Project Management theory and practice*, 2nd ed. New Delhi: Pearson, 2015.

[2] S. C. Sharma, *Construction Equipment and Management,* New Delhi: Khanna Publishing Co.(P) Ltd., 2019.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: appraise the financing aspects, operation and maintenance of construction equipment*
*CO2: choose earthmoving and drilling equipment*
*CO3: select suitable hoisting and conveying equipment*
*CO4: evaluate value of equipment and adapt artificial intelligence in construction*

**Course Articulation Matrix (CAM): P20SC202 CONSTRUCTION TECHNIQUES & EQUIPMENTS**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC202.1** | 1 | 1 | 1 | - | 1 |
| CO2 | **P20SC202.2** | 1 | 1 | 1 | - | 1 |
| CO3 | **P20SC202.3** | 1 | 1 | 1 | - | 1 |
| CO4 | **P20SC202.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC202** | | 1 | 1 | 1 | 1 | 1 |

## P20SC203A EARTHQUAKE RESISTANT DESIGN OF RCC STRUCTURES

**Class:**M.Tech. II – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**

This course will develop students 'knowledge in/on...

*LO1: basic concepts of earthquake and its quantification*

*LO2: principles of conceptual and earthquake resistant design*

*LO3: seismic evaluation of reinforced concrete and masonry buildings*

*LO4: seismic effect on structural and non-structural elements*

### UNIT-I (9)

**Earthquake and Ground Motion**: Earthquake phenomenon, causes of earthquakes, faults, plate seismic tectonics, wave terms associated with earthquakes, magnitude, intensity of an earthquake, scales, energy released

**Earthquake Measuring Instruments**: Seismoscope, Seismograph, Accelerograph, characteristics of strong ground motions, seismic zones of India

### UNIT – II (9)

**Conceptual Design**: Functional planning, continuous load path, overall form, simplicity and symmetry, elongated shapes, stiffness and strength, horizontal and vertical tremors, twisting of building

**Earthquake Resistant Design**: Seismic design requirements, regular and irregular configurations, basic assumptions, design earthquake loads, load combinations, Equivalent lateral force method, Response spectrum method

### UNIT –III (9)

**Seismic Evaluation**: Principles of earthquake resistant deign of reinforced concrete members, structural models for frame buildings, seismic methods of analysis, seismic design methods, IS code-based methods for seismic design, seismic evaluation and retrofitting, vertical irregularities, plan configuration problems

**Masonry Buildings**: Elastic properties of masonry assemblage, categories of masonry buildings, behavior of unreinforced and reinforced masonry walls, behavior of walls, box action and bands, behavior of infill walls, improving seismic behavior of masonry buildings, load combinations and permissible stresses, seismic design requirements

## UNIT-IV (9)

**Structural Walls:** Strategies in the location of structural walls, sectional shape, variations in elevation, cantilever walls without openings, failure mechanism of non-structures

**Non-Structural Elements:** Effects of non-structural elements on structural system, analysis of non- structural elements, prevention of non-structural damage, isolation of non-structures

**Text Book:**

[1] S. K. Duggal, *Earthquake Resistant Design of structures,*2nd ed. Oxford University Press, 2013.

**Reference Books:**

[1] Pankaj Agawal and Manish Shrikhande, *Earthquake Resistant Design of structures,*2nd ed. Prentice Hall of India Pvt. Ltd., 2007.

[2] T.Paulay and M.J.N. Priestly, *Seismic Design of Reinforced Concrete and Masonry Building,*1st ed. John Wiley & Sons, 1992.

[3] Anand.S.Arya, *Masonry and Timber structures including earthquake Resistant Design,* 1st ed. Nem Chand &Bros, 1987.

[4] C.V.R. Murty, *Earthquake Tips - Learning Earthquake Design and construction*, National Information Centre of Earthquake Engineering, Indian Institute of Technology Kanpur, 2005.

[5] BIS, IS: 1893 (part-1)-2002,*Criteria for Earthquake Resistant-Design of structures,*New Delhi: Bureau of Indian Standards.

[6] BIS, IS 4326: 1993, *Earthquake Resistant Design and Construction of Building*, New Delhi: Bureau of Indian Standards.

[7] BIS, IS 13920: 2016, *Ductile detailing of concrete structures subjected to seismic force,* New Delhi: Bureau of Indian Standards.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: interpret the basic concepts and measure different earthquake parameters*
*CO2: adapt the principles of conceptual and earthquake resistant design*
*CO3: design of reinforced concrete and masonry buildings*
*CO4: predict the seismic effect on structural and non-structural elements*

**Course Articulation Matrix (CAM): P20SC203AEARTHQUAKE RESISTANT DESIGN OF RCC STRUCTURES**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC203A.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC203A.2** | 2 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC203A.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC203A.4** | 2 | 1 | 1 | 1 | 1 |
| **P20SC203A** | | **1.5** | **1** | **1** | **1** | **1** |

## P20SC203B DESIGN OF SPECIAL STRUCTURES

**Class:**M.Tech. II-Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on...
*LO1: structural behavior of flat slabs and grid slabs*
*LO2: analysis of deep beams and shear walls*
*LO3: analysis of roof trusses and gantry girder*
*LO4: structural aspects on bunkers and silos*

### UNIT – I (9)

**Flat Slabs:** Components, BIS codal recommendations, direct design and equivalent methods, design for flexure and shear
**Grid Slabs:** General features, Approximate method, Plate theory, BIS codal provisions, analysis and design

### UNIT –II (9)

**Deep Beams:** Minimum thickness, steps for designing, design by BIS method
**Shear Walls:** Classification of walls, type of loads, design of rectangular and flanged shear walls

### UNIT– III (9)

**Roof Trusses:** Types of trusses,components, types of loads, wind load consideration, analysis and design of roof trusses, portal and gable frames
**Gantry Girder:** Type of loads,Permissible stresses, types of girders, components, design of gantry girder

### UNIT – IV (9)

**Steel Bunkers:** Types of bunkers, assumptions, Jansen's and Airy's theories, BIS codal provisions, design of square bunker
**Silos:** Types of loads, BIS codal provisions, design of cylindrical silo, side plates, ring girder

**Text Books:**


[1] P.C. Varghese, *Advanced Reinforced Concrete Design*, 2nd ed. Jodhpur: Prentice Hall of India Pvt. Ltd., 2005 *(Chapters 4, 6, 10-13, and 19)*

[2] B. C. Punmia, Ashok Kr. Jain and Arun Kr. Jain, *ComprehensiveDesign of Steel Structure*, 2nd ed. New Delhi: Lakshmi Publishers, 2005. *(Chapters 9 and 16)*


**Reference Books:**


[1] Ramchandra and Virendra Gehlot, *Design of Steel Structures-II,* 9th ed. New Delhi: Scientific Publishers, 2015.

[2] B.C. Punmia, Ashok Kr. Jain and Arun Kr. Jain, *RCC Designs (Reinforced Concrete Design),* 10th ed. New Delhi: Lakshmi Publishers, 2015.

[3] Ramaswamy. G. S, *Design and Construction of concrete shell roofs,* New Delhi: CBS Publishers, 2005

[4] KrishnaRaju. N, *Design of Reinforced concrete Structures,* 3rd ed. New Delhi: CBS Publisher, 2015.

[5] Arya Azmani, *Design of Steel Structures*, New Delhi: New Chand Publisher, 2011

[6] BIS, IS 456: 2000, *Code of practice for Plain and reinforced concrete*, New Delhi:Bureau of Indian standards, 2000.

[7] BIS, IS 875 (part 1-5),*Code of practice for Design loads*, New Delhi: Bureau of Indian standards, 1987.

[8] BIS, SP: 16,*Design Aids for Reinforced Concrete to IS 456: 1978*,New Delhi: Bureau of Indian standards, 1980.

[9] BIS, IS 800:2007, *General construction in steel -Code of practice*, 3rd ed. New Delhi: Bureau of Indian standards, 2007.

[10] BIS, SP: 6 (1-7),*Handbook for structural engineers*, New Delhi: Bureau of Indian standards, 1980

[11] BIS, IS 9178: 2010, *Criteria for design of Steel Bins for storage of bulk materials,* New Delhi: Bureau of Indian standards, 2010.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: analyze, design of flat slabs and grid slabs.*
*CO2:design the segments of deep beams and shear walls.*
*CO3: develop the sections of roof truss and gantry girder*
*CO4: estimate the dimensions of steel bunkers and silos*

| **Course Articulation Matrix(CAM):P20SC203B DESIGN OF SPECIAL STRUCTURES** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO1** | **PSO2** |
| CO1 | **P20SC203B.1** | 1 | - | 1 | 1 | 1 |
| CO2 | **P20SC203B.2** | 1 | - | 1 | 1 | 1 |
| CO3 | **P20SC203B.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC203B.4** | 1 | 1 | 1 | 1 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **P20SC203B** | **1** | **1** | **1** | **1** | **1** |

## P20SC203CREPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

**Class:**M.Tech. II – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on...
*LO1: failure and diagnose distress of structures*
*LO2: case studies of damage and reserve strength of structure*
*LO3: materials for repairing and their techniques*
*LO4: techniques of retrofitting and rehabilitation*

### UNIT-I (9)

**Failure of Structures:**Review of the construction theory, performance problems, responsibility and accountability, case studies - learning from failures, causes of distress in structural members, design and material deficiencies, over loading

**Diagnosis and Assessment of Distress:**Visual inspection, non-destructive tests, ultrasonic pulse velocity method, rebound hammer technique, penetration resistance, pull out tests, core sampling and testing, chemical tests, carbonation tests and chloride content, corrosion potential assessment - cover meter survey, half-cell potentiometer test, resistivity measurement

### UNIT-II (9)

**Case Studies:** Studies of RCC buildings subjected to distress, identification and estimation of damage, structural integrity and soundness assessment, interpretation and evaluation of results

**Evaluation:** Evaluation of reserve strength of existing structures, active and passive repairs, selection of repair materials for concrete, essential parameters for repair materials, strength and durability aspects

### UNIT-III (9)

**Materials:**Materials for repair, premixed cement concrete and mortars, polymer modified mortars and concrete, epoxy and epoxy systems, polyester resins, coatings

**Repair Techniques:** A suitable repair option for certain damage in a structure, repair stages, repair methods, guniting, shortcreting, polymer concrete system, reinforcement

replacement, strengthening concrete by surface impregnation, polymer and epoxy overlays

## UNIT-IV (9)

**Retrofitting:** Resin/polymer modified slurry injection, plate bonding technique, ferro cement jacketing, RCC jacketing, propping and supporting, repair methods, fiber wrap technique, foundation rehabilitation methods, chemical and electrochemical method of repair

**Rehabilitation:** Strategies, Stress reduction technique, repair and strengthening of columns and beams, rehabilitation strategies, compressive strength of concrete, cracks/joints, masonry, foundation, base isolation

**Text Book:**


[1] CPWD, *Handbook on Repair and Rehabilitation of RCC buildings,* 1st ed. New Delhi: Govt. of India Press, 2002.


**Reference Books:**


[1] R.N. Raikar,*Learning from failures - Deficiencies in Design, Construction and Service,* 1st ed. New Bombay: R and D Centre (SDCPL), 1987.

[2] ACI 562-16, *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures and Commentary,* US: ACI Committee, 2019.

[3] Santha Kumar A.R, *Concrete Technology,* 2nd ed. New Delhi: Oxford University Press, 2018.

[4] DovKaminetzky,*Design and Construction Failures,* 1st ed. New Delhi: Galgotia Publications Pvt. Ltd., 2001.

[5] S. M. Johnson, *Deterioration, Maintenance and repair of structures,* 1st ed. New Delhi: Krieger Publishing Company, 1980.

[6] R. T. Allen and S. C. Edwards*, Repair of Concrete Structures,* 1st ed. UK: CRC Press, 1992.


**Course Learning Outcomes (COs):**
On completion of this course, students will be able to...

*CO1: assess the causes for distress and estimate the deterioration of structures*
*CO2: evaluate distress in the structure*
*CO3: recommend materials for repairing and their techniques*
*CO4: formulate guidelines for repair techniques of deteriorated structures*

**Course Articulation Matrix (CAM): P20SC203C REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC203C.1** | 1 | - | 1 | 1 | - |
| CO2 | **P20SC203C.2** | 1 | 1 | 1 | 1 | - |
| CO3 | **P20SC203C.3** | 1 | - | 1 | 1 | 1 |
| CO4 | **P20SC203C.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC203C** | | **1** | **1** | **1** | **1** | **1** |

## P20SC204A QUALITY AND SAFETY MANAGEMENT

**Class:**M.Tech. II-Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Exam: | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: quality control methods and standards*
*LO2: quality assurance and management in construction industry*
*LO3: safety concepts and requirements applied to construction industry*
*LO4: risk management in construction industry*

### UNIT-I (9)

**Construction Quality**: Significance of quality- inspection, control, assurance, philosophies, management, periodical changes in quality system
**Quality Standards**: Quality standards, standards organizations,common standards used in building construction projects, principles of quality in construction projects, progress in quality of construction projects

### UNIT-II (9)

**Quality Assurance:** Quality assurance in construction, International Organization for Standardization (ISO), ISO certification, ISO- 9000, ISO-14000, ISO-18000 Quality management system, Quality System Documentation, Quality audit – categories, process
**Quality Management**: Total quality management (TQM), quality tools, design tools-Six Sigma, Design of experiments (DOE), lean tool, quality in construction projects

### UNIT-III (9)

**Construction Safety**: Evolution of safety, accident causation theories, foundation of major injury, health and safety act and regulations, cost of accidents, roles of safety personnel, causes of accidents, principles of safety
**Safety Management System:** Safety policy and organization, safety budget, safety organization, education and training, safety plan, safety manual, safety committee, incentive programs, accident reporting, investigation and record keeping, research

results in safety management

## UNIT- IV (9)

**Risk in Construction:** Risk identification process - analysis and evaluation process, risk management process, risk treatment strategies

**Insurance in Construction Industry:** Fundamental principles of insurance, project insurance, marine cum erection insurance, fire policy, professional indemnity policy, common examples of business and project risk, risks faced by Indian construction companies assessing international project

**Text Books:**


[1] Abdul RazzakRumane, *Quality Management in Construction Projects*, New York:CRC Press, 2017.*(Chapter 1-4)*

[2] Kumar Neeraj Jha, *Construction Project Management*, 2nd ed.New Delhi: Pearson, 2015. *(Chapters14 and 15)*


**Reference Books:**


[1] Dr. S.Seetharaman *Construction Engineering and Management,* 5th ed. New Delhi: Umesh publications, 2019.

[2] Tim Howarthand David Greenwood, *Construction Quality Management:Principles and Practice*, Routledge, NY, 2017.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: apply quality standards and philosophies*
*CO2: recommend quality assurance aspects and standards in construction industry*
*CO3: interpret hazards in construction and adapt safety measures*
*CO4: identify risk and suggest suitable mitigation strategy*

**Course Articulation Matrix (CAM): P20SC204A QUALITY AND SAFETY MANAGEMENT**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC204A.1** | 1 | 1 | 1 | - | 1 |
| CO2 | **P20SC204A.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC204A.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC204A.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC204A** | | 1 | 1 | 1 | 1 | 1 |

## P20SC204B SUSTAINABLE CONSTRUCTION ENGINEERING

**Class:**M.Tech. II -Semester

**Specialization:**Structural & Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**

This course will develop students 'knowledge in/on…

*LO1: concepts of sustainability and governing principles*

*LO2:green and sustainable building materials*

*LO3: energy and carbon reduction in buildings*

*LO4: building performance towards sustainability*

### UNIT-I (9)

**Sustainability Concepts:** Definitions of sustainability, pillars of sustainability, circle of sustainability, need for sustainability, engineering principles of sustainability, systems approach to sustainability

**Green Buildings:** Green buildings, sustainable buildings, climate change, global warming, national, international policies and their regulations of sustainability

### UNIT-II (9)

**Sustainable Building Materials:** Sustainable building materials, qualities, use, examples, natural building materials, locally available and locally manufactured materials, bio materials, salvaged and recycled materials, nontoxic materials: low VOC paints, coating and adhesives

**Selection of Sustainable Materials:** Issues in selecting green materials, pragmatic view of green materials, priorities in selection process, life cycle assessment of building materials, sustainable concrete production

### UNIT-III (9)

**Energy and Carbon Reduction:** Building energy issues,high performance building design strategy, goal setting for high performance, passive design strategy – shape, orientation, and massing, lighting, ventilation, passive cooling, composite beam and panel, furnicular shells, filler slabs, reinforced concrete masonry, vaulted roofs, ferro-cement walls

**Applications in Built Environment:**Concepts of green buildings, climate responsive building, Indoor Environmental Quality (IEQ), issues, factors, acoustics transmission, lighting quality, thermal comfort conditions, odours, volatile organic compounds, humidity, integrated IEQ

## UNIT-IV (9)

**Indian Green Building Rating Systems and Codes:** Approach to sustainability,Green building rating systems: IGBC and GRIHA rating tools for building assessment, Codes and regulations for green building

**The Future of Sustainable Buildings:** Business case of high-performance green buildings,design and construction strategies, reinventing the construction industry, challenges and opportunities

**Text Books:**


[1] Charles J Kibert,*Sustainable Construction Green Building Design and Delivery*, 3rd ed.Canada: John Wiley & Sons, 2014. *(Chapters 6-9,12,13and15)*

[2] Steve Goodhew, *Sustainable Construction Processes*, London:John Wiley & Sonspublisher, 2016. *(Chapters 1-9)*


**Reference Books:**


[1] Gajanan M. Sabnis, *Green Building with concrete – sustainable design and construction*, London: CRC Press, 2016.

[2] Gursharan Singh Kainth, *Climate Change, Sustainable Development and India*, LAP Lambert Academic Publishing, 2011.

[3] *Sustainable Building - Design Manual Part I and II*, The Energy and Resources Institute, TERI, 2004.

[4] Linda Reeder, *Guide to Green Building Rating Systems: Understanding LEED, Green Globes*, John Wiley & Sons publisher, 2010.

[5] Margaret Robertson *Sustainability Principles and Practice*, 2nd ed.Routledge publisher, 2014.

[6] Traci Rose Rider, Stacy Glass, Jessica McNaughton, *Understanding Green Building Materials* W.W. Norton and Company, 2011.


**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: infer the significance of sustainability in construction engineering*
*CO2: appraise and select sustainable building materials*
*CO3: interpret the energy and carbon reduction strategies*
*CO4: design and construct sustainable building*

| Course Articulation Matrix (CAM): P20SC204B SUSTAINABLE CONSTRUCTION ENGINEERING | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| **CO1** | **P20SC204B.1** | 1 | 1 | 1 | 1 | 1 |
| **CO2** | **P20SC204B.2** | 1 | 1 | 1 | 1 | 1 |
| **CO3** | **P20SC204B.3** | 1 | 1 | 1 | 1 | 1 |
| **CO4** | **P20SC204B.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC204B** | | **1** | **1** | **1** | **1** | **1** |

## P20SC204C URBAN INFRASTRUCTURE PLANNING AND MANAGEMENT

**Class:**M.Tech. II -Semester

**Specialization:**Structural & Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
*LO1: urban infrastructure development and system performance*
*LO2:socio-economic and environmental implications*
*LO3: urban planning and designing for sustainability*
*LO4: urban infrastructure performance towards sustainability*

### UNIT-I (9)

**Urban Infrastructure:** Infrastructure,evaluating infrastructure projects, cities and civilization, framework for project evaluation – identification, analysis of alternatives, assessing and comparing alternatives, implementation, evaluation

**System Performance:** Performance of infrastructure-based systems, system cost – total, average, marginal and incremental, resource requirement, lifecycle cost, profitability, breakeven volume, return on investment, service capacity, safety, security and risk, case studies

### UNIT-II (9)

**Public Perspectives and Concerns:** General overview – differences between public and private perspectives, benefit-cost analysis – brainstorming, monetary values of cost and benefit analysisand decision-making adjustments

**Socio-Economic and Environmental Aspects:** Economic – measures related to regional and national economy, environment – ecosystem, pollution, wetlands, wild life habitat, renewable resourcesand climate change, social – positive and negative issues, framework for assessing social impacts, case studies

### UNIT-III (9)

**Urban Eco-Design for Buildings:** Territorial facilities – eco-design approach, Essential notions, decision about space, eco-design for transportation, land use and spatial planning and their systematic analysis

**Sustainable Urban Planning:** Concepts and components of ecology and ecosystem, types of pollution: causes, effects and control; role of planner for location of treatment plants and industries, abatement measures of noise, air and land pollution, concept of eco-city, decay causes and remedies; urban renewal missions, role of urban planners in disaster management, concept of smart city

## UNIT-IV (9)

**Infrastructure Rating Systems and Codes:** Approach to sustainability, Codes and regulations for green building, Indian building assessment tools

**Challenges and Opportunities:** Green buildings for competitive business models, design and construction strategies, reinventing the construction industry, challenges and opportunities

**Text Books:**


[1] Carl D. Martland,*Toward more Sustainable Infrastructure: Project Evaluation for Planners and Engineers*, London:John Wiley & Sons, 2011. *(Chapters 1-5)*

[2] Pratap Rao, *Urban Planning Theory and Practices*, CBS Publishers, 2014. *(Chapters 1-3,5,6and 8-12)*


**Reference Books:**


[1] Margaret Roberts,*Town Planning techniques,*Hutchinson Educational Publication, 2012.

[2] Rehana Tariq, *Sustainable Urbanization and urban Development,*New Delhi: New Academic Publishers, 2008.

[3] N.V. Modak and V.N. Ambdekar, *Town and Country Planning and Housing*, Orient Longman Limited.

[4] Gajanan M. Sabnis, *Green Building with concrete – sustainable design and construction*, London: CRC Press, 2016

[5] Gursharan Singh Kainth, *Climate Change, Sustainable Development and India*, LAP Lambert Academic Publishing, 2011.

[6] *Sustainable Building - Design Manual Part I and II*, The Energy and Resources Institute, TERI, 2004.

[7] Linda Reeder, *Guide to Green Building Rating Systems: Understanding LEED, Green Globes*, John Wiley & Sons publisher, 2010.

[8] Margaret Robertson *Sustainability Principles and Practice*, 2nd ed. Routledge publisher, 2014.

[9] Traci Rose Rider, Stacy Glass, Jessica McNaughton, *Understanding Green Building Materials* W.W. Norton and Company, 2011.


**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: articulate the urban planning for circular ecosystem*
*CO2: appraise the sustainable aspects and cost implications in urban infrastructure planning*
*CO3: integrate eco-design for urban planning*
*CO4: validate rating for urban infrastructure*

| Course Articulation Matrix (CAM): P20SC204C URBAN INFRASTRUCTURE PLANNING AND MANAGEMENT | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO1** | **PSO2** |
| CO1 | **P20SC204C.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC204C.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC204C.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC204C.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC204C** | | **1** | **1** | **1** | **1** | **1** |

## P20SC205 STRUCTURAL ENGINEERING SOFTWARE APPLICATIONS LABORATORY

**Class:**M.Tech. II-Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 4 | 2 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
*LO1: type of loadings in buildings*
*LO2: STAAD-PRO in using design of RCC, steel structures*
*LO3: design of RC beams, columns, slabs, footings and retaining walls using Matlab*
*LO4:design of steel beams, columns and connections using Matlab*

### LIST OF EXPERIMENTS

1. Analysis and design of RCC multi-storey building using STAADPRO for vertical loads (dead, live load etc.).
2. Analysis and design of RCC multi-storey building using STAADPRO for vertical and horizontal loads (wind load, seismic loads etc.).
3. Analysis and design of steel structure using STAADPRO for various loads (dead, live, wind load).
4. Analysis and design of roof truss using STAADPRO.
5. Analysis of structure for rolling loads using STAADPRO.
6. Analysis of water tank using finite element meshing in STAADPRO.
7. Developing design charts for RC beams using Matlab/spread sheets.
8. Developing design charts for columns and footings using Matlab/spread sheets.
9. Developing design charts for retaining walls using Matlab/spread sheets.
10. Developing design charts for steel beams using Matlab/spread sheets.
11. Developing design charts for steel columns using Matlab/spread sheets.
12. Developing design charts for bolted / welded connections using Matlab/spread sheets.

**Laboratory Manual:**

[1] *Structural Engineering Software Applications Laboratory Manual,* prepared by faculty of Civil Engineering Department, KITSW.

**Reference Books:**


[1] Krishnamurthy D, *Structural Design and Drawing -Vol. II and III,* 2nd ed.CBS Publishers, 2010.

[2] BIS, IS800:2007, *General Constructions in Steel,*3rded. New Delhi: Bureau of Indian Standards, 2007.

[3] BIS, IS 456:2000, *Plain and Reinforced Concrete-Code of Practice,* New Delhi: Bureau of Indian Standards, 2000.

[4] BIS,SP34, *Handbook on Concrete Reinforcement and Detailing,* New Delhi: Bureau of Indian Standards.

[5] C.S. Krishnamurthy and S. Rajeev, *Computer Aided Design*, 2nd ed. Alpha science International, 2005.

[6] Boyd C. Panbou, *Computer applications in Construction*, 1st ed. Tata McGraw-Hill Co. Ltd., 1994.

[7] Bansal, Goel Sharma, MATLAB *and its Applications in Engineering*, 2nd ed. New Delhi: Pearson Publications.

[8] Bentley Staad V8i – Select series.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to...

*CO1: analyse the structures for both vertical and horizontal loads in buildings using STAADPRO*

*CO2: design RCC and steel structures using STAADPRO*

*CO3: develop working drawings of RC beams, columns, slabs, footings and retaining walls through programming*

*CO4: generate charts for design of steel beams, columns and connections through programming*

**Course Articulation Matrix (CAM): P20SC205 STRUCTURAL ENGINEERING SOFTWARE APPLICATIONS LABORATORY**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC205.1** | 1 | 2 | 1 | 1 | 1 |
| CO2 | **P20SC205.2** | 1 | 2 | 1 | 1 | 1 |
| CO3 | **P20SC205.3** | 1 | 2 | 1 | - | 1 |
| CO4 | **P20SC205.4** | 1 | 2 | 1 | - | 1 |
| **P20SC205** | | **1** | **2** | **1** | **1** | **1** |

## P20SC206 INFRASTRUCTURE DESIGN AND DRAWING LABORATORY

**Class:**M.Tech. II-Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 4 | 2 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**

This course will develop student's knowledge in/on…

*LO1:RCC sub structure elements*

*LO2: RCC super structure elements*

*LO3: steel structural elements*

*LO4: industrial structural elements*

### LIST OF EXPERIMENTS

**Design and draft working drawings of following RCC Structures:**

1. Rectangular Column and Footing.
2. Combined footing with two columns.
3. One-way, two-way Slab and beam system.
4. Cantilever Retaining wall.
5. T-beam bridge deck.
6. Underground Rectangular Water Tank.
7. Elevated circular water Tank.

**Design and draft working drawings of following Steel Structures**

1. Foundation, column base and Built-up column.
2. Simple Steel Roof Trusses.
3. Eave Strut of Industrial building.
4. Plate Girder (welded).
5. Beam and Column Connection and detailing.
6. Gantry girder.
7. Steel water Tank.

**Laboratory Manual:**

[1] *Infrastructure Design and Drawing Laboratory Manual,* prepared by faculty of Civil EngineeringDepartment, KITSW.

**Reference Books:**

[1] Krishnamurthy D, *Structural Design and Drawing - Vol. II and III,* CBS Publishers, 2010.

[2] BIS, IS800:2007, *General Constructions in Steel,* 3rdrevision, New Delhi: Bureau of Indian Standards, 2007.
[3] BIS,IS 456:2000, *Plain and Reinforced Concrete-Code of Practice,* New Delhi: Bureau of Indian Standards, 2000.
[4] BIS, SP34 *Handbook on Concrete Reinforcement and Detailing,* New Delhi: Bureau of Indian Standards
[5] BIS, IS 875 Part 1, 2 and 3: 2003, *Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice-Dead Load*, New Delhi: Bureau of Indian standards, 2003.
[6] BIS, IS 3370 Part 1& Part 2: 2009, *Indian Standard Concrete Structures for Storage of Liquids-Code of Practice-General Requirements, Code of Practice,* New Delhi: Bureau of Indian standards, 2009.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to...

*CO1: interpret drawings of RCC sub structure elements*
*CO2: develop drawings of RCC super structures*
*CO3: create drawings of steel structures*
*CO4: analyze drawings of Industrial structural elements*

**Course Articulation Matrix (CAM): P20SC206 INFRASTRUCTURE DESIGN AND DRAWING LABORATORY**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC206.1** | 1 | 2 | 1 | - | 1 |
| CO2 | **P20SC206.2** | 1 | 2 | 1 | - | 1 |
| CO3 | **P20SC206.3** | 1 | 2 | 1 | - | 1 |
| CO4 | **P20SC206.4** | 1 | 2 | 1 | - | 1 |
| **P20SC206** | | **1** | **2** | **1** | **-** | **1** |

## P20SC207MINI PROJECT WITH SEMINAR

**Class:**M.Tech.II - Semester **Specialization:**Structural and Construction Engineering

**TeachingScheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 4 | 2 |

**ExaminationScheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 100 |
| End Semester Examination | --- |

**Course LearningObjectives (LOs)**:
This course will develop students' knowledge on /in…
*LO1: implementing a project independently by applying knowledge to practice*
*LO2: literature review and well-documented report writing*
*LO3: creating PPTs and effective technical presentation skills*
*LO4: writing technical paper in scientific journal style & format and creating video pitch*

**Continuous Internal Evaluation (CIE) for Mini Project with Seminar:**

1) The *Post Graduate Mini Project Evaluation Committee (PGMPEC)*shall be constituted with HoD as a Chairman, M.Tech. Coordinator as a Convener and three to five other faculty members representing various specializations in that particular programme as members.
2) Student has to take up independent mini project on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student.
3) *PGMPEC* shall allot a faculty supervisor to each student for guiding on
   (a) Selection of topic
   (b) Literature survey and work to be carried out
   (c) Preparing a report in proper format
   (d) Right conduct of research and academic activity to promote academic integrity
   (e) Use of anti-plagiarism software to detect plagiarism in the report and submission of Mini project report within acceptable plagiarism levels
   (f) Effective mini project oral presentation before the PGMPEC

   There shall be only Continuous Internal Evaluation (CIE) forseminar

4) The CIE for mini project is as follows:

| Assessment | Weightage |
|---|---|
| Mini project Supervisor Assessment | **20%** |
| PGMPEC Assessment:<br>*(i) Registration presentation* ***(10%)***<br>*(ii) Working model / process / software package / system developed* ***(20%)***<br>*(iii) Mini project report* ***(20%)***<br>*(iv) Mini project paper* ***(10%)***<br>*(v) Mini project video pitch* ***(10%)***<br>(vi) *Final presentation (with PPT) and viva-voce* ***(10%)*** | **80 %** |
| **Total Weightage:** | **100%** |

**Note:** It is mandatory for the student to

(i) appear for final presentation (with PPT) and viva-voce to qualify for course evaluation

(ii) write mini project paper in given journal format

(ii) create a good video pitch to present mini project

a) **Mini Project Topic**: The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals/Technical Magazines on the topics of potential interest

b) **Working Model**: Each student is requested to develop a working model/ process/ software package /system on the chosen work and demonstrate before the *PGMPEC*as per the dates specified by *PGMPEC*

c) **Mini Project Report:** Each student is required to submit a well-documented mini project report as per the format specified by*PGMPEC*

d) **Anti-Plagiarism Check:** The mini project report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the *PGMPEC*as per the schedule notified by thedepartment

f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her mini project. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (*if any*) and social impact

5) The student has to register for the Mini project as supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce

ii) he/she fails to submit the report in prescribed format

iii) he/she fails to fulfill the requirements of Mini project evaluation as per specified guidelines

6) (a) The CoE shall send a list of students registered for supplementary to the HoD concerned

(b) The PGMPEC, duly constituted by the HoD, shall conduct Mini project evaluation and send the award list to the CoE within the stipulated time

**Course Learning Outcomes (COs)**:
On completion of this course, students will be able to…

*CO1: apply knowledge to practice to design and conduct experiments and utilize modern tools for developing working models / process / system leading to innovation and entrepreneurship*

*CO2: demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report*

*CO3: make an effective oral presentation through informative PPTs, showing knowledge on the subject and sensitivity towards social impact of the Mini project*

*CO4: write a "Mini project paper" in scientific journal style and format from the prepared Mini*

| **Course Articulation Matrix (CAM): P20SC207MINI PROJECT WITH SEMINAR** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO 1** | **PSO 2** |
| CO1 | **P20SC207.1** | 2 | - | 2 | 2 | 2 |
| CO2 | **P20SC207.2** | 2 | - | 2 | 2 | 2 |
| CO3 | **P20SC207.3** | - | 2 | - | 1 | 1 |
| CO4 | **P20SC207.4** | - | 2 | - | 1 | 1 |
| **P20SC207** | | **2** | **2** | **2** | **1.5** | **1.5** |

## P20AC208A STRESS MANAGEMENT BY YOGA

**Class:** M.Tech. II – Semester Specialization(s): SCE, DE, VE, PE,SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
**This course will develop students 'knowledge in/on**

*LO1: awareness about different types of stress*
*LO2: yoga in the management of stress*
*LO3: positive health and overall wellbeing*
*LO4: prevention of stress related health problems by yoga practice*

### UNIT – I (6)

**Stress:** Definition of Stress, Types of stress - acute and chronic, stressors, definition of yoga from various sources, types of yoga – karma yoga, gnana yoga, bhakti yoga and raja yoga, concept of bhagavadgita, yoga versus exercise, basics of physiology and psychology, brain and its parts– Central Nervous System (CNS), Peripheral Nervous System (PNS), Hypothalamic Pituitary Adrenal (HPA) axis, sympathetic and parasympathetic nervous systems, fight and flight mechanism, relationship between stress and yoga

### UNIT –II (6)

**Ashtanga Yoga:** Do's and don'ts in life, yamas – ahimsa, satya, asteya, bramhacharya and aparigraha, niyama – shaucha, santosha, tapa, svadhyaya, ishvarapranidhana, asana, pranayama, pratyahara, dharana, dhyana, samadhi

### UNIT– III (6)

**Asana and Stress:** Definition of asana from patanjali, origin of various names of asanas, various yoga poses and their benefits for mind and body, sequence of performing asanas - standing, sitting, lying down on stomach, lying down on back and inverted postures, activation of annamaya kosha, effect on various chakras, systems and glands thereby controlling the stress levels through the practice of asanas

## UNIT - IV (6)

**Pranayama**: Anulom and vilompranayama, nadishudhipranayama, kapalabhatipranayama, bhramaripranayama, nadanusandhanapranayama

**Meditation Techniques**: Om meditation, cyclic meditation, Instant Relaxation Technique (IRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

**Text Books:**

[1] *Yogic Asanas for Group Training - Part-I*, Nagpur: Janardhan Swami Yogabhyasi Mandal.
[2] Swami Vivekananda, *Rajayoga or Conquering the Internal Nature*, Kolkata: Advaita Ashrama (PublicationDepartment).

**Reference Books:**

[1] Nagendra H.R and Nagaratna R, *Yoga Perspective in Stress Management*, Bangalore : Swami Vivekananda Yoga Prakashan.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to ...

*CO1: differentiate yoga and exercise*
*CO2: explain eight steps of Ashtanga yoga*
*CO3: describe different yogasanas, and their benefits for mind and body*
*CO4: discuss the benefits of pranayama and meditation as an effective tool for stress management*

| **Course Articulation Matrix (CAM): P20AC208A STRESS MANAGEMENT BY YOGA** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20AC208A.1** | 1 | 1 | - | - | - |
| CO2 | **P20AC208A.2** | 1 | 1 | - | - | - |
| CO3 | **P20AC208A.3** | 1 | 1 | - | - | - |
| CO4 | **P20AC208A.4** | 1 | 1 | - | - | - |
| **P20AC208A** | | **1** | **1** | **-** | | **-** |

## P20AC208B: VALUE EDUCATION

**Class:** M.Tech. II – Semester Specialization(s): SCE, DE, VE, PE,SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs)**:
This course will develop students' knowledge on /in…
*LO1: value of education and self-development*
*LO2: importance of cultivation of values*
*LO3: personality and behavior development*
*LO4: character and competence*

### UNIT – I (6)

**Values and self-development:** Social values and individual attitudes, work ethics,Indian vision of humanism, moral and non-moral valuation, standards and principles, value judgments

### UNIT – II (6)

**Importance of cultivation of values:** Sense of duty, devotion, self-reliance, confidence, concentration, truthfulness, cleanliness, honesty, humanity, discipline, power of faith, national unity, patriotism, love for nature

### UNIT – III (6)

**Personality and Behavior Development:** Soul and scientific attitude, Positive thinking, integrity, discipline and punctuality, love and kindness, avoid fault thinking, free from anger, dignity of labor

**Universal brotherhood and religious tolerance:** True friendship, Love for truth, happiness vs suffering, aware of self-destructive habits, association and cooperation, doing best for saving nature

### UNIT – IV (6)

**Character and Competence:** Holy books vs blind faith, self-management and good health, science of reincarnation, equality, non-violence, humility, role of women, all religions and same message, mind your mind, self-control, honesty, studying effectively

**Text Book:**

[1] S. K. Chakroborty, *Values and Ethics for organizations: Theory and practice*, New Delhi: Oxford University Press, 2000.

**Reference Books:**


[1] D. N. Grose, *A text book of Value Education,* New Delhi: Dominant Publishers and Distributors, 2005.

[2] Yogesh Kumar Singh and Ruchika Nath, *Value Education*, New Delhi: A. P. H. Publishing Corporation, 2005.

[3] S. P. Ruhela, *Human Values and Education,* New Delhi: Sterling Publishers Pvt. Ltd.,1986.

[4] V. Narayan Karan Reddy, *Man, Education and Values,* New Delhi: B. R. Publishing Corporation, 1979.

[5] Bharatwaj Tilak Raj, *Education of Human Values,* 2nd ed.New Delhi: MittalPublications, 2001.


**Course Learning Outcomes (COs)**:

On completion of this course, students will be able to…

*CO1: illustrate social & moral values and inculcate Indian vision of humanism*
*CO2: develop sense of duty, national unity and love for nature*
*CO3: utilize positive thinking and develop universal brotherhood*
*CO4: build character & competence through holy books*

**Course Articulation Matrix (CAM):P20AC208B: VALUE EDUCATION**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20AC208B.1** | - | 1 | - | - | - |
| CO2 | **P20AC208B.2** | - | 2 | - | - | - |
| CO3 | **P20AC208B.3** | - | 1 | - | - | - |
| CO4 | **P20AC208B.4** | - | 2 | - | - | - |
| **P20AC208B** | | - | 1.5 | - | - | - |

## P20AC208CPERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

**Class:**M.Tech. II-Semester **Specialization(s)**: SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students' knowledge on/in…
*LO1: holistic development of personality*
*LO2:accomplishmentof day to day responsibilities and to achieve the highest goal*
*LO3:basic knowledge to maintain a stable mind, pleasing personality and determination*
*LO4:personality building towards becoming a role model*

### UNIT – I (6)

**Holistic Development of Personality:** Neetisatakam - verses-19, 20, 21, 22(wisdom), verses-29, 31, 32 (pride& heroism), verses-26, 28, 63, 65(virtue), verses-52, 53, 59(don'ts), verses-71, 73, 75, 78(do's)

### UNIT – II (6)

**Approach to Day to DayWork and Duties:** Shrimad bhagwadgeeta - chapter2-verses 41, 47, 48 chapter3-verses 13, 21, 27, 35, shrimadbhagwadgeeta - chapter6-verses 5, 13, 17, 23, 35, chapter18-verses 45, 46, 48

### UNIT – III (6)

**Statements of Basic Knowledge:** Shrimad bhagwadgeeta- chapter2-verses 56, 62, 68 chapter12-verses 13, 14, 15, 16, 17, 18

### UNIT – IV (6)

**Personality of Role Model:** Shrimad bhagwadgeeta - chapter2-verses 17, chapter3-verses 36,37,42 chapter4-verses 18,38,39, chapter18-verses 37,38,63

**Text Book:**

[1] Swami Swarupananda, *Shrimad Bhagavad Geeta*, Advaita Ashram(Publication Department),Kolkata:Printed in Sharada Press, Car Street, Mangalore.

**Reference Books:**


[1] Prof. SatyavrataSiddhantalankar, *Bhagavad Geeta* , New Delhi: Oriented Publishing.

[2] P.Gopinath,*Bhartrihari's Three Satakam (Niti-sringar-vairagya),* New Delhi: Rashtriya Sanskrit Sansthanam.

[3] Maharaja Bhadrihari, *Nithishatakam Translated by P.Jwala Dutta Sharma*, Dharm Diwakar Press, Moradabad, 1909, First Edition.

[4] *world.com/section_personality_development.html.*


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to…

*CO1: build a holistic personality*

*CO2: develop himself to accomplish his responsibilities and achieve his highest goal in life*

*CO3: perceive basic knowledge to maintain stable mind, pleasing personality and determination*

*CO4: originate himself to become a role model thus leading mankind to peace and prosperity*

| **Course Articulation Matrix (CAM): P20AC208CPERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEMENT SKILLS** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20AC208C.1** | 2 | 1 | 1 | - | - |
| CO2 | **P20AC208C.2** | 2 | 1 | 1 | - | - |
| CO3 | **P20AC208C.3** | 2 | 1 | 1 | - | - |
| CO4 | **P20AC208C.4** | 2 | 1 | 1 | - | - |
| **P20AC208C** | | **2** | **1** | **1** | **-** | - |

## P20AC208D DISASTER MANAGEMENT

**Class:**M.Tech. II – Semester **Specialization(s)**: SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 1 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on…
*LO1: disaster management cycle and relation between disaster & development*
*LO2: risk / vulnerability assessment and reduction strategies*
*LO3: management strategies, approaches, frameworks and governance*
*LO4: disaster mitigation aspects and recovery strategies*

### UNIT – I (6)

**Introduction to Disaster:** Concepts of hazard, vulnerability & risks, natural and manmade disasters- earthquake, cyclone, floods , volcanoes; famine, displaced populations, industrial & transport accidents, slow and rapid onset disasters - famine, draught , epidemics , air crash, tidal waves & tsunami

**Mitigation and Management techniques of Disaster**: Basic principles of disasters management, disaster management cycle, political, social, economic impacts of disasters, gender and social issues during disasters, principles of psychosocial issues and recovery during emergency situations, impact of disaster on development, different stake holders in disaster relief, refugee operations during disasters, human resettlement and rehabilitation issues during and after disasters, intersectoral coordination during disasters, models in disasters

### UNIT –II (6)

**Disaster Risk and Vulnerability:** Introduction to disaster risk and vulnerability, risk analysis techniques, process of risk assessment, analytical systems for risk assessment, natural hazard/ risk assessment, understanding climate risk, mapping of risk assessment, decision making for risk reduction, problems in risk assessment, strategies for risk reduction, community-based risk reduction, observation and perception of vulnerability, vulnerability identification, vulnerability types and dimensions, vulnerability and social and economic factors

**Preparedness and Response**: Disaster preparedness significance & measures, institutional mechanism for disaster preparedness, disaster preparedness policy & programmes, concept and significance of disaster preparedness plan, community-based disaster preparedness plan, prediction, early warnings and safety measures of

disaster,resource mobilization, post disaster reliefs & logistics management, emergency support functions and coordination mechanism

## UNIT– III (6)

**Disaster Management and Governance:** Institutional arrangements, disaster management strategies & approaches, Community Based Disaster Preparedness (CBDP) - components, teams, preparedness, linkages with development programmes

**Disaster Response in India:** Legal framework, National disaster management Act, 2005, Institutions for disaster management – NDMA, NIDM, Role of government agencies, NCMC committee, crisis management group, need, media, community resilience, social & economic problems, funding mechanism

## UNIT - IV (6)

**Disaster Risk Mitigation:** Background, strengthening, sendai framework and strengthening disaster risk governance, responsibility matrix

**Disaster Recovery:** Scope, approach, recovery process, steps involved in recovery process, early, mid& long-term recovery, reconstruction, coordination–central, state, & private sectors and voluntary organizations, rehabilitation–economical and psychological

**Text Books:**


[1] Manual on *Natural Disaster Management in India*, M C Gupta, NIDM, New Delhi, 2016*(Chapters 1- 5,7,9 &10).*

[2] N. G. Dhawan, A. S. Khan, *Disaster Management and Preparedness*, 1st ed. New Delhi: CBS Publication, 2014. *(Chapters 1,2,3,4,6,7,8 &10).*


**Reference Books:**


[1] Ashok Kumar and Vipul Anekant, *Challenges to internal security of India*, Tata McGraw hill,2020.

[2] Larry R. Collins, *Disaster management and Preparedness*, CRC Press, 2004.

[3] Tony Moore and Raj Lanka, *Hand book of Disaster and Emergency Management*, 3rd ed.Elsevier, 2006.

[4] R. K. Dave, *Disaster Management in India: Challenges and Strategies*, Prowess Publishing, 2018.

[5] M. M. Sulphey, *Disaster Management*, 1st ed.Prentice Hall of India, 2016.

[6] M. Pandey, *Disaster Management*, 1st ed. Wiley India, 2014.

[7] R. B. Singh, *Natural Hazards and Disaster Management: Vulnerability and Mitigation*, Noida: Rawat Publications, 2006.

**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1:categorize disasters, analyse the phases of disaster management cycle and relation between disaster & development*

*CO2: perform risk / vulnerability assessment and devise response & preparedness strategies for risk / vulnerability reduction*

*CO3: identify the role of government and private agencies involved in disaster assistance*

*CO4: analyse the mitigation measures and recovery strategies to inculcate a culture of resilience*

| **Course Articulation Matrix (CAM): P20AC208D DISASTER MANAGEMENT** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20AC208D.1** | 2 | 1 | 1 | - | - |
| CO2 | **P20AC208D.2** | 2 | 1 | 1 | - | -- |
| CO3 | **P20AC208D.3** | 1 | 1 | - | - | |
| CO4 | **P20AC208D.4** | 2 | 1 | - | 1 | 1 |
| **P20AC208D** | | **1.75** | **1** | **1** | 1 | 1 |

**PRR-20**

**DEPARTMENT OF CIVIL ENGINEERING**
**KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15**
*(An Autonomous Institute under Kakatiya University, Warangal)*
**SCHEME OF INSTRUCTION & EVALUATION FOR TWO YEAR POSTGRADUATE PROGRAMME**
**M.TECH. (STRUCTURAL AND CONSTRUCTION ENGINEERING)**

## SEMESTER-III

| Sr. No. | Course Type | Course Code | Course Name | Teaching scheme | | | Credits | Evaluation Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIE - TA | | | | | | | ESE | Total Marks |
| | | | | | | | | I²RE | | | | Minor | MSE | Total | | |
| | | | | L | T | P | | ATLP | CRP | CP | PPT | | | | | |
| 1 | PE | P20SC301 | Professional Elective-V/ MOOC-V | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 2 | OE | P20OE302 | Open Elective-I/ MOOC-VI | 3 | - | - | 3 | 8 | 8 | 8 | 6 | 10 | 20 | 60 | 40 | 100 |
| 3 | PROJ | P20SC303 | Dissertation Phase – I/Industrial Project (*to be continued in IV – Semester also as Dissertation Phase – II*) | - | - | 18 | 9 | - | - | - | - | - | - | 100 | - | 100 |
| 4 | PROJ | P20SC304 | Internship Evaluation | - | - | 2 | - | - | - | - | - | - | - | 100 | - | 100 |
| | | | Total: | 6 | - | 20 | 15 | | | | | | | 320 | 80 | 400 |

**[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]**

**Elective- 5**

P20SC301A: AI & ML applications in Construction Engineering
P20SC301B: Theory of Elasticity
P20SC301C: Finite Element Method
P20DS301D:MOOCs

**Open Elective**

P20OE302A: Business Analytics
P20OE302B: Industrial Safety
P20OE302C: Operations Research
P20OE302D: Cost Management of Engineering Projects
P20OE302E: Composite Materials
P20OE302F: Waste to Energy
P20OE302G: Renewable Energy Sources
P20OE302H: MOOCs

**Total Contact Periods/Week: 26** **Total Credits: 15**

## P20SC301A AI & ML Applications in Civil Engineering

**Class:** M.Tech. III-Semester **Specialization:** Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students' knowledge in/on…

*LO1: machine learning*
*LO2:concepts of machine learning (ML) and large-scale data analytics tools in solving civil engineering problems*
*LO3: decision problem analysis and training dataset preparation*
*LO4: Understanding on the Evolutionary algorithms and their applications in civil engineering*

### UNIT-I (9)

**Introduction to ML:** History of ML, necessities, ML in modern civil engineering, real-world application examples
**Supervised Learning:** Probably Approximately Correct (PAC) Learning, classification and regression using linear and nonlinear models, logistic regression, gradient descent

### UNIT-II (9)

**Bayesian Learning**: Bayes theorem, concept learning, Bayesian networks, parametric methods, model selection procedures, risk minimization, multilayer perceptronand support vector machines
**Unsupervised Learning**: Dimensionality reduction, clustering, Expectation-maximization (EM) algorithm

### UNIT-III (9)

**Decision Trees**: Univariate trees, multivariate trees, graphical models and their temporal extensions, exact and approximate inference methods, parameter estimation
**Probability**: Probability, Bernoulli distribution, binomial, multinominal distribution

### UNIT-IV (9)

**Introduction to AI-based Technologies**: Overview of the foundational principles that drive AI-based technologies, Basics of optimization, objective functions, constraints, principles of optimality, single and multi-objective optimization, pareto optimality

**Introduction to Nature Inspired Optimization Techniques**: Genetic algorithms, ant colony optimization, particle swarm optimization, comparison with classical methods, hands on using standard test functions and practical projects

**Text Books:**


[1] Alpaydin, Ethem, *Introduction to machine learning*, MIT press, London: Second Edition, 2010. (*Chapters 1, 2, 3, 4, 6, 7, 9, 10, 11, 16)*

[2] Engelbrecht, Andries P., *Computational intelligence: an introduction*, John Wiley & Sons, 2007. (*Chapters: 1, 8, 9, 16, 17*)


**Reference Books:**


[1] Tom M. Mitchell, *Machine Learning*, New Delhi: McGrawHill Education (India) Private Limited, 2013.

[2] Stephen Marsland, *Machine Learning: An Algorithmic Perspective*, CRC Press, 2015.

[3] BishopC., *Pattern Recognition and Machine Learning*, Berlin: Springer Verlag.

[4] Smola, Alex, and S. V. N. Vishwanathan, *Introduction to machine learning*, Cambridge University Press, First edition, 2008.

[5] Yuen, Ka-Veng, *Bayesian methods for structural dynamics and civil engineering*, John Wiley & Sons, 2010.

[6] Yu X, Gen M, *Introduction to evolutionary algorithms*, Springer Science & Business Media, 2010 Jun 10.

[7] Bansal, Jagdish Chand, Pramod Kumar Singh, and Nikhil R. Pal, eds. *Evolutionary and swarm intelligence algorithms*, Springer2019.

[8] Yang XS, *Nature-inspired metaheuristic algorithms*, Luniver press, 2010.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: apply the concept of optimization technique and solving complex problem*

*CO2: evaluate the critical Civil Engineering problems by using the concepts of machine learning (ML) and large-scale data analytics tools.*

*CO3: implement decision-making process for decision problem analysis and identifying the best alternative solution*

*CO4: employ the concept of meta-heuristic algorithms in solving real-world problems*

| **Course Articulation Matrix (CAM): P20SC301AAI & ML Applications in Civil Engineering** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC301A.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20SC301A.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC301A.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20SC301A.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC301A** | | 1 | 1 | 1 | 1 | 1 |

## P20SC301B THEORY OF ELASTICITY

**Class:**M.Tech. III – Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
*LO1: concepts and principles of stress, strain behaviour of continuum*
*LO2: stress analysis problems in 2D based on compatibility conditions, equilibrium equations*
*LO3: concept of Airy's stress functions for 2-D plane stress and plane strain problems in cylindrical coordinate systems*
*LO4: torsion of non-circular bars*

### UNIT-I (9)

**Fundamentals:** Notation of stress, components of stress and strain, generalized Hooke's law, stress and strain in three dimensions, stress components on an oblique plane, surface traction, transformation of stress components under change of co-ordinate system

**Stress and Strain Tensors:** Analysis of stress and strain in three dimensions,principal stresses and principal planes, stress invariants, mean and deviator stress, strain energy per unit volume, octahedral shear stress, strain of a line element, principal strains, volume strain

### UNIT-II (9)

**Two Dimensional Problems in Rectangular Coordinates:** Plane stress and plane strain situations, equilibrium equations, compatibility equations, St.Venant's principle, uniqueness of solution, stress components in terms of Airy's stress functions

**Applications of 2D Problems in Rectangular Coordinates:** Applications to cantilever, simply supported and fixed beams with sample loading

### UNIT-III (9)

**Two Dimensional Problems in Polar Coordinates:** Equilibrium equations, stress strain components, compatibility equation, applications usingAiry's stress functions in polar co-ordinates for stress distributions symmetric about an axis

**Applications of Two-Dimensional Problems in Polar Coordinates:** Effect of hole on stress distribution in a plate in tension, stresses due to load at a point on a semi-infinite straight boundary, stresses in a circular disc under diametrical loading

## UNIT-IV (9)

**Torsion:** Torsion of various shapes of bars, stress function method of solution applied to circular and elliptical bars, Prandtl's membrane analogy

**Torsion Problems in Elasticity:** Solution of torsion of rectangular bars by Raleigh Ritz method and Finite difference method

**Text Book:**

[1] Timoshenko and Goodier, *Theory of Elasticity*, 3rd ed. New Delhi: McGraw Hill, 2017.

**Reference Books:**

[1] Sadhu singh, *Theory of Elasticity*, 4th ed. 12th reprint New Delhi: Khanna Publishers, 2018.
[2] Martin H. sadd, *Elasticity- Theory, Applications, Numeris*, 4th ed. Elsevier Sciencepublisher, 2020.
[3] L.S.Srinadh, *Advanced Mechanics of Solids*, 3rd ed. New Delhi: TMH Publishing Company Ltd.
[4] C.T. Wang, *Applied Elasticity,* McGrawHill Inc.,US published in 1953, digitalized on 21st Nov 2007.

**Course Learning Outcomes (COs):**
On completion of this course, students will be able to...

*CO1: evaluate the stress, strain invariants of continuum in Cartesian coordinate system*
*CO2: analyze plane stress and plane strain problems in 2D*
*CO3: constitute plane stress and plane strain problem in polar coordinate system*
*CO4: predict the torsion equation of an elliptical cross section bar by analogous method*

**Course Articulation Matrix (CAM): P20SC301B THEORY OF ELASTICITY**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20SC301B.1** | 1 | - | 1 | 1 | - |
| CO2 | **P20SC301B.2** | 1 | - | 1 | 1 | - |
| CO3 | **P20SC301B.3** | 1 | - | 1 | 1 | - |
| CO4 | **P20SC301B.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC301B** | | **1** | **1** | **1** | **1** | **1** |

## P20SC301C FINITE ELEMENT METHOD

**Class:**M.Tech. II-Semester **Specialization:**Structural and Construction Engineering

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Exam | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on…
***LO1:*** *principles of finite element method*
***LO2:*** *general and isoperimetric elements*
***LO3:*** *formulation of stiffness matrix for trusses, beams and frames*
***LO4:*** *stiffness matrices for two dimensional and axi-symmetric elements*

### UNIT – I (9)

**Concepts of Finite Element Method:** History**,** introduction, basic concepts, need for study, advantages, disadvantages, basic equations of elasticity – plane stress, plane strain and axi-symmetric problems, steps in finite element method
**Finite Element Formulation:** Virtual work and variational principle, Galerkin's Method, Finite Element Method: displacement approach, stiffness matrix and boundary conditions, assembly of global stiffness matrix

### UNIT – II (9)

**General Elements:** Basic element shapes, properties - natural coordinates, triangular elements, rectangular elements, Lagrange and serendipity elements
**Isoperimetric Elements:** Isoperimetric formulation,development of stiffness matrix, application to bar element, plane quadrilateral element, numerical integration: one- and two-dimensional elements using gauss - quadrature and Jacobian methods

### UNIT – III (9)

**Trusses and Beams:** Formulation of stiffness matrices for truss and beam members, assembly of elements and solution techniques for static loads
**Plane frames:** Formulation of stiffness matrix for plane frame, assembly of elements and solution techniques for static loads

### UNIT – IV (9)

**Two Dimensional Elements:** Formulation and evaluation of stiffness matrix for various 2D elements-constant strain triangle, linear strain triangle, rectangular elements

**Axi-symmetric Elements:** Axi-symmetric element, applications of axisymmetric elements, finite element formulation of axi-symmetric element

**Text Books:**


[1] P. Seshu, *Finite Element Analysis*, 10thed. New Delhi: PHI Learning Pvt. Ltd.,2012. (*Chapters 1-6*)

[2] R. Tirupati, Chandupatla and D. Ashok Belegundu, *Finite Elements Methods in Engineering,* 2nd ed. New Delhi: Pearson Education Publications, 1997. (*Chapters 1, 3, and 5-7*)


**Reference Books:**


[1] Singeresu S.Rao, *The Finite Element Methods in Engineering*, 4th ed. Elsevier Publication, 2009.

[2] O. C. Zienkiewicz, R. L. Taylor, *The Finite Element Method*, 5thed. New Delhi: Butterworth and Heinemann publishers, 2000.

[3] C. S. Krishna Murthy, *Finite Element analysis– Theory and Programming,*2nded. New Delhi: Tata McGraw Hill, 2001.

[4] S. S. Bhavikatti, *Finite element analysis*, New Age International Publishers, 2005.

[5] D. Robert Cook,S. David Malkus and E. Michael Plesha, *Concepts and Applications of Finite Element Analysis*, 4th ed. John Wiley and Sons, 2007.


**Course Learning Outcomes (COs):**

On completion of this course, students will be able to...

*CO1: appraise importance of formation of elements in finite element method*
*CO2: develop stiffness matrices for isoperimetric elements*
*CO3: analyze trusses, beams and frames by developing stiffness matrices*
*CO4: formulate stiffness matrices for two dimensional solids and axi-symmetric members*

| **Course Articulation Matrix (CAM): P20SC301C FINITE ELEMENT METHOD** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20SC301C.1** | 1 | - | 1 | 1 | - |
| CO2 | **P20SC301C.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20SC301C.3** | 1 | 1 | 1 | 1 | - |
| CO4 | **P20SC301C.4** | 1 | 1 | 1 | 1 | 1 |
| **P20SC301C** | | **1** | **1** | **1** | **1** | **1** |

## P20OE302ABUSINESS ANALYTICS

**Class:**M.Tech. III – Semester **Specialization(s)**: SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**

This course will develop student's knowledge in/on

*LO1: fundamental concepts of business analytics and descriptive analytics*
*LO2: data collection and data visualization methods*
*LO3: text analysis and simulation methods in business analytics*
*LO4: social media, web and health care analytics*

### UNIT-I (9)

**Introduction to Business Analytics:**Introduction to business analytics, why analytics, business analytics: the science of data-driven decision making, business context, technology data science, descriptive analytics, predictive analytics, prescriptive analytics descriptive, predictive and prescriptive analytics techniques, big data analytics, web and social media analytics, machine learning algorithms, framework for data-driven decision making, analytics capability building, roadmap for analytics capability building, challenges in data-driven decision making and future

**Descriptive Analytics:**Introduction to descriptive analytics, data types and scale, structured and unstructured data, cross-sectional, time series and panel data, types of data measurement scales, population and sample, measures of central tendency, percentile, decile and quartile, measures of variation

### UNIT-II (9)

**Data Collection:**Iintroduction, the value of data, data collection preliminaries, data collection methods, data types, problem formulation preliminaries,challenges in data collection, data collation,validation and presentation, data collection in the retailing industry

**Data Visualization:** Introduction, motivating example, methods of data visualization, software and data visualization

### UNIT-III (9)

**Text Analytics:** Introduction, motivating text analysis, methods of text analysis, natural language processing

**Simulation:** Introduction, motivating examples, simulation modeling method and case studies

## UNIT-IV (9)

**Applications of Business Analytics:**Introduction, what is social media and web analytics, display advertising in real time, a/b experiments for measuring value of digital media and handling e-retailing challenges, strategies for mobile devices, the future of social media analytics

**Health Care Analytics:** Introduction, methods of health care analytics

**Textbooks:**


[1] U Dinesh Kumar, *Business Analytics: The Science of Data-Driven Decision Making*, 1st ed. 2017. *(Units-I)*

[2] BhimasankamPochiraju,Sridhar S, *Essentials of Business Analytics: A Textbook*,1st ed.Springer Nature Switzerland, 2019. *(Units-II, III, IV)*


**Reference Books:**


[1] R N Prasad, Seema Acharya, *Fundamentals of Business analytics: Big Data*, 2nd ed. Wiley Publications, 2017.

[2] Foster Provest, Tom Fawcett,*Data Science for Business*, 1st ed. USA: O'Reilly, 2013.


**Course Learning Outcomes (COs)**:
On completion of this course, the students will be able to…

*CO1: describe the concepts of business analytics and descriptive analytics*
*CO2: apply the data collection and data visualization methods in business analytics*
*CO3: categorize text analysis and simulation methods in business analytics*
*CO4: apply social media & web analytics and health care analytics in real world problems*

**Course Articulation Matrix (CAM): P20OE302A BUSINESS ANALYTICS**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20OE302A.1** | - | - | - | - | - |
| CO2 | **P20OE302A.2** | 1 | 1 | - | - | - |
| CO3 | **P20OE302A.3** | 1 | 1 | - | - | - |
| CO4 | **P20OE302A.4** | 2 | 2 | - | - | - |
| **P20OE302A** | | **1.33** | **1.33** | - | - | - |

## P20OE302B INDUSTRIAL SAFETY

**Class:**M. Tech. III - Semester **Specialization(s)**:SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students' knowledge in/on…
*LO1: need for safety in industries*
*LO2: fundamentals of maintenance engineering*
*LO3: causes for wear& corrosion and method of lubrication*
*LO4: faults tracing in equipments and importance of preventative maintaince*

### UNIT –I (9)

**Industrial Safety:** Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 - for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, safety color codes, fire prevention and firefighting, equipment and methods

### UNIT –II (9)

**Fundamentals of Maintenance Engineering:** Definition and aim of maintenance engineering, primary and secondary functions and responsibility of maintenance department, types of maintenance, types and applications of tools used for maintenance, maintenance cost & its relation with replacement economy, service life of equipment

### UNIT –III (9)

**Prevention of Wear and Corrosion:** Wear- types, causes, effects, wear reduction methods, lubricants - types and applications, lubrication methods, general sketch, working and applications- screw down grease cup, pressure grease gun, splash lubrication, gravity lubrication, wick feed lubrication, side feed lubrication, ring lubrication, definition, principle and factors affecting the corrosion, types of corrosion, corrosion prevention methods

## UNIT –IV (9)

**Fault Tracing and Preventative Maintaince:** Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment - machine tool, pump, air compressor, internal combustion engine, boiler, electrical motors, types of faults in machine tools and their general causes, periodic and preventative maintaince, advantages of preventative maintaince, repair cycle importance

**Textbook**:


[1] John Ridley and John Channing, *Safety at work*, 6th ed. UK: Elsevier Butterworth-Heinemann, 2003. *(Unit 1& Unit 2) chapter (2,3,5,6,7,8).*

[2] Amit Gupta, *Industrial Safety and environment*, New Delhi: Laxmi Publications (P) LTD, 2006., 1973., *(Unit3 & Unit 4) chapters (10,11,12,13,14,15,16,17).*


**Reference Books:**


[1] R. Keith Mobley Editor, Lindley R. Higgins Darrin J. Wikoff, *Maintenance Engineering Handbook*, 7th ed. New York: Mc Graw Hill International, 2008.

[2] Mohammed Ben–Daya,UdayKumar, Prabhakar Murthy D.N, *Introduction to Maintenance Engineering*, New Delhi: Wiley India Pvt. Ltd., 2016.


**Course Learning Outcomes(COs):**

Upon completion of this course, students will be able to…

*CO1: summarize the principles of industrial safety and maintenance*

*CO2: describe the functions of maintenance department and list the types of maintenance & tools used for maintenance*

*CO3: identify the causes for wear, tear& corrosion and suitable lubrication method for a given application*

*CO4: describe the significance of decision-tree and apply it for problems in equipment to detect and classify the faults and need of preventative maintenance*

**Course Articulation Matrix (CAM) P20OE302B INDUSTRIAL SAFERTY**

| COs | | PO1 | PO2 | PO3 | PS01 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20OE302B.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20OE302B.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20OE30B.3** | 1 | 1 | 1 | 1 | 1 |
| CO4 | **P20OE302B.4** | 1 | 1 | 1 | 1 | 1 |
| **P20OE302B** | | **1** | **1** | **1** | **1** | **1** |

## P20OE302COPERATIONS RESEARCH

**Class:**M. Tech. III - Semester **Specialization(s)**:SCE, DE, VE, PE, SE, DS, DC &CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop students 'knowledge in/on
*LO1: linear programming problems*
*LO2: nonlinear optimization problem*
*LO3: sequencing, scheduling and network model*
*LO4: decision making theory and queuing models*

### UNIT – I (9)

**Linear Programming Problem (LPP):** Mathematical formulation of LPP, solution of linear programming problems-simplex method, artificial variable technique, duality in LPP and Dual Simplex method, sensitivity analysis

### UNIT –II (9)

**Non-Linear Programming Problem (NLPP):** Classification of NLPP, unconstrained optimization techniques- iterative methods - random search methods, steepest decent method, conjugate gradient method, Fibonacci method and golden section method

**Constrained Optimization Techniques**-- Lagrange 's method and Kuhn-Tuckermethod

### UNIT– III (9)

**Sequencing and Scheduling:** Sequencing and scheduling of n jobs one, two and three machine problems, scheduling of n jobs through k machines problem

**Project Network:** Network construction-CPM and PERT, resource analysis in network problems

### UNIT - IV (9)

**Decision Analysis and Game Theory:** Introduction, decisions under uncertainty-laplace criterion, max-min criterion, savage criterion and Hurwitz criterion, game theory-introduction, two person zero sum games and the maximin-minimax principle, mixed strategy games- graphical method and linear programming method, dominance property

**Queuing Theory**-Elements and operating characteristics of a queuing system, Poisson queuing systems, study of single server queuing model with infinite capacity

**Text Books:**

[1] Kantiswarup, P.K.Gupta, Man Mohan, *Operations Research,*16th ed.New Delhi:S. Chand & Sons, 2013. *(Chapters: 2, 4, 5, 6, 12, 16, 17, 21, 25, 27)*

[2] S.S. Rao,*Optimization Techniques,* 3rd ed. New Delhi: New Age International,2013. *(Chapters: 6)*

**Reference Books:**

[1] H.A. Taha, *Operations Research an Introduction,*6th ed.Prentice Hall of India, 2006.

[2] N.D Vohra, *Quantitative Techniques in Management*, 3rd ed. TMH, 2010.

**Course Learning Outcomes (COs):**

On completion of this course, students will be able to ...

*CO1: model engineering real time problems and solve them using various LPP techniques*
*CO2:optimize the engineering problems using NLPP methods*
*CO3: apply the tools and techniques to solve sequencing and scheduling problems and project network models*
*CO4: analyze conflicting situations using game theory and solve various queuing model parameters*

**Course Articulation Matrix (CAM): P20OE302C: OPERATIONS RESEARCH**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20OE302C.1** | 2 | 1 | 1 | - | - |
| CO2 | **P20OE302C.2** | 2 | 1 | 1 | - | - |
| CO3 | **P20OE302C.3** | 2 | 1 | 1 | 1 | 1 |
| CO4 | **P20OE302C.4** | 2 | 1 | 1 | - | - |
| **P20OE302C** | | **2** | 1 | **1** | 1 | 1 |

## P20OE302D COST MANAGEMENT OF ENGINEERING PROJECTS

**Class:**M.Tech. III-Semester

**Specialization(s):**SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs)**:
This course will develop students' knowledge on /in…
*LO1: cost concepts, objectives of costing system, project management*
*LO2: standard costing, cost control and reduction*
*LO3: cost behavior, profit planning and types of budgets*
*LO4: quantitative techniques for cost management*

### UNIT-I (9)

**Overview of Cost Accounting:** Cost concepts in decision making, objectives of a costing system, different costs of projects - relevant cost, differential cost, incremental cost, opportunity cost, activity-based costing

**Project**: Meaning, Types of projects, benefits of project management, project life cycle

### UNIT-II (9)

**Standard Costing:** Meaning,advantages and limitations, standard costing in manufacturing and process industries, standard costing and standardized costing, standard cost and estimated cost

**Cost Control and Reduction:** Cost control meaning, distinction between cost control and cost reduction, advantages and disadvantages of cost control and cost reduction, cost control techniques, essential for success of cost controls and cost reduction programme, areas of cost reduction, tools and techniques of cost reduction

### UNIT-III (9)

**Cost Behavior and Profit Planning:** Marginal cost, absorption cost, break-even analysis, Cost-Volume-Profit (CVP) analysis, Profit-Volume (PV) ratio, Sales ratio, margin of safety.

**Budgets**: Budgetary control, flexible budget, performance-based budgets, zero based budgets

## UNIT-IV (9)

**Quantitative Techniques for Cost Management:** Linear Programming Problems (LPP includes graphic method and simplex method), transportation problems, assignment problems

**Text Books:**


[1] S.P. Jain, K.L.Narang, *Advanced Cost Accounting*, New Delhi: Kalyani Publishers, 2014 *(Chapter 7, 10 ,11 13, 14, 16 &27 )*

[2] N.D. Vohra, *Quantitative Techniques in Management*, 3rd ed. New Delhi: Tata McGraw Hill Book Co. Ltd. 2007 *(Chapter 2,3, 5 and 6)*


**Reference Books:**


[1] Ashish K. Bhattacharya, *Principles & Practices of Cost Accounting*, 3rd ed. New Delhi: Prentice Hall India Learning Private Limited, 2004.

[2] Harold Kerzner, *Project Management: A systems approach to Planning, Scheduling and Controlling*, 10th ed.New Delhi: John Wiley & Sons Inc., 2009.

[3] V K Kapoor, *Operations Research,* New Delhi: Sultan Chand & Sons, 2013.

[4] Charles T. Horngren and George Foster, *Cost Accounting A Managerial Emphasis*, New Delhi: Prentice Hall of India, 1991.


**Course Learning Outcomes (Cos):**
Upon completion of this course, the student will be able to…

*CO1:interpret overview of cost accounting and project management*
*CO2: distinguish standard costing in manufacturing and process industries, estimate cost control and reduction*
*CO3: estimate cost behavior, profit planning and budget*
*CO4: apply quantitative techniques for linear programming, transportation and assignment problems*

| **Course Articulation Matrix (CAM): P20OE302DCOST MANAGEMENT OF** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20OE302D.1** | 1 | 1 | 1 | 1 | 1 |
| CO2 | **P20OE302D.2** | 1 | 1 | 1 | 1 | 1 |
| CO3 | **P20OE302D.3** | 2 | 1 | 1 | 1 | 1 |
| CO4 | **P20OE302D.4** | 2 | 1 | 1 | 1 | 1 |
| **P20OE302D** | | **1.5** | **1** | **1** | **1** | **1** |

## P20OE302ECOMPOSITE MATERIALS

**Class:**M.Tech. III-Semester

**Specialization(s):**SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives(LOs):**
This course will develop students' knowledge in/on…
*LO1: composite material properties and applications*
*LO2: properties and applications of fibers and rule of mixture*
*LO3: manufacturing and applications of metal matrix, ceramic matrix and carbon-carbon composites*
*LO4: polymer matrix composites, manufacturing and applications*

### UNIT- I (9)

**Composite Materials:** Definition, classification, characteristics, advantages, applications, functional requirements of reinforcement and matrix, effect of reinforcement on composite performance - size, shape, distribution and volume fraction

### UNIT-II (9)

**Reinforcements:** Preparation - layup, curing, fibers-glass, carbon, Kevlar, boron, properties and applications- fibers, whiskers, particle reinforcements, mechanical behavior of composites, rule of mixtures, inverse rule of mixtures, isostrain and isostress conditions

### UNIT-III (9)

**Manufacturing of Metal Matrix Composites:** Casting – solid state diffusion technique, cladding – hot isostatic pressing, properties and applications

**Manufacturing of Ceramic Matrix Composites:** Liquid metal infiltration – liquid phase sintering, properties and applications

**Manufacturing of Carbon/carbon Composites**: Knitting, braiding, weaving, properties and applications

### UNIT-IV (9)

**Manufacturing of Polymer Matrix Composites**: Preparation of molding compounds and prepregs, manufacturing of polymer matrix composites - hand layup, autoclave, filament winding, compression molding and reaction injection molding, properties and applications

**Text Books:**

[1] Chawla K.K., *Composite Materials*, 4th ed. New York: Springer, Verlag, 2019. (*Chapters 1, 2, 5, 6, 7 & 8*)

**Reference Books:**

[1] Agarwal, B.D. and Broutman, L. J., *Analysis and Performance of Fiber Composites*, 4th ed.USA: John Wiley & Sons, 2017.
[2] Strong A.B., *Fundamentals of Composite Manufacturing*, 2nded. SME, 2007.
[3] Sharma S.C., *Composite materials*, 1sted. New Delhi: Narosa Publications, 2000.
[4] Mathews F.L. and Rawlings R.D., *Composite materials: Engineering and Science*, 1st ed.England: Chapman and Hall, 1994.
[5] Krishnan K., Chawla *Composite Materials Science and Engineering*, India: Springer Private Limited, 2009.
[6] P.K. Mallick, *Fiber Reinforced Composite materials, Manufacturing and Design*, New York: CRC Press, Taylor and Francis Group, 2010.

**Course Learning Outcomes (COs)**:
On completion of this course, students will be able to…

*CO1: classify composite materials and explain their applications*
*CO2: outline properties and applications of reinforcements*
*CO3: categorize manufacturing methods for metal matrix composite, ceramic matrix composite, carbon/carbon composite and their properties.*
*CO4: compare manufacturing methods of polymer matrix composites*

**Course Articulation Matrix (CAM): P20OE302E COMPOSITE MATERIALS**

| CO | | PO1 | PO2 | PO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **20OE302E.1** | 1 | 1 | 1 | 1 | - |
| CO2 | **20OE302E 2** | 1 | 1 | 1 | 1 | - |
| CO3 | **20OE302E.3** | 1 | 1 | 1 | 1 | - |
| CO4 | **20OE302E.4** | 1 | 1 | 1 | 1 | - |
| **20OE302E** | | **1** | **1** | **1** | 1 | - |

## P20OE302F : WASTE TO ENERGY

**Class:**M.Tech. III-Semester

**Specialization(s):**SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs)**:
This course will develop students' knowledge on /in…
*LO1: concept of waste to energy*
*LO2: production of energy form waste*
*LO3: technologies for waste to energy*
*LO4: standards for waste to energy plants and carbon credits*

### UNIT – I (9)

**Introduction:** Principles of waste management and waste utilization, waste management hierarchy and 3R principle of reduce, reuse and recycle, waste as a resource and alternate energy source

**Waste Sources & Characterization:** Waste production in different sectors such as domestic, industry and agriculture, classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous), characterization of waste for energy utilization

### UNIT – II (9)

**Technologies for Waste to Energy:** Biochemical conversion – energy production from organic waste through anaerobic digestion and fermentation, thermo-chemical conversion – combustion, incineration and heat recovery, pyrolysis, gasification, plasma arc technology

**Waste to Energy Options:** Landfill gas, collection and recovery, Refuse Derived Fuel (RDF) – Fluff, Briquettes, Pellet, Alternate Fuel Resource (AFR) – production and use in cement plants, thermal power plants and industrial boilers, conversion of wastes to fuel resources for other useful energy applications, energy from plastic wastes – non-recyclable plastic waste for energy recovery, energy recovery from wastes and optimization of its use, benchmarking and standardization, energy analysis

## UNIT – III (9)

**Energy production**: Waste activities – collection, segregation, transportation and storage requirements, location and siting of 'waste to energy' plants, industry specific applications – in-house use – sugar, distillery, pharmaceuticals, pulp and paper, refinery and petrochemical industry

**Centralized and Decentralized Waste to Energy Plants:** Centralized and decentralized energy production, distribution and use, comparison of centralized and decentralized systems and its operations

## UNIT-IV (9)

**Waste to Energy & Environmental Implications:** Environmental standards for waste to energy plant operations and gas clean-up, savings on non-renewable fuel resources

**Carbon Credits**: Carbon foot print calculations and carbon credits transfer mechanisms

**Text Book:**


[1] *Waste to Resources: A Waste Management Handbook*, NewDelhi: TERI Press,2014. *(Unit – I, III & IV)*

[2] Sunil Pandey, *Industrial and Urban Waste Management in India*, New Delhi : TERI Press, 2015 (Unit –II)


**Reference Books:**


[1] Banwari Lal and Patwardhan ,*Wealth from Waste: Trends and Technologies*, New Delhi :TERI Press, 2014.

[2] S.N Mukhopadhyay, *Fundamentals of waste and Environmental Engineering*, New Delhi: TERI Press, 2016.

[3] Gazette Notification on Waste Management Rules 2016.

[4] CPCB Guidelines for Co-processing in Cement/Power/Steel Industry.


**Course Learning Outcomes (COs)**:
On completion of this course, students will be able to…

*CO1: outline the operations of waste sources and alternate energy sources*
*CO2: adopt waste to energy technologies*
*CO3: list the stages of waste to energy production*
*CO4: appraise environmental standards and estimate carbon foot print*

| Course Articulation Matrix (CAM) P20OE302F WASTE TO ENERGY | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO1** | **PO2** | **PO3** | **PSO1** | **PSO2** |
| CO1 | **P20OE302F.1** | 1 | 1 | 1 | - | - |
| CO2 | **P20OE302F.2** | 1 | 1 | 1 | - | - |
| CO3 | **P20OE302F.3** | 1 | 1 | 1 | - | - |
| CO4 | **P20OE302F.4** | 1 | 1 | 1 | 1 | 1 |
| **P20OE302F** | | 1 | 1 | 1 | 1 | 1 |

## P20OE302G : RENEWABLE ENERGY SOURCES

**Class:**M.Tech. III-Semester

**Specialization(s):**SCE, DE, VE, PE, SE, DS, DC & CSP

**Teaching Scheme:**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Examination Scheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course Learning Objectives (LOs):**
This course will develop student's knowledge in/on

*LO1: different types of renewable energy sources and principles of solar energy systems*
*LO2: principles of wind energy and geothermal energy systems*
*LO3: harnessing energy from oceans and biomass*
*LO4: working of fuel cells and different types of energy storage systems*

### UNIT-I (9)

**Introduction:** Conventional and non-conventional sources of energy – brief description of different renewable energy sources

**Solar energy:** Introduction to prospects of solar PV systems: photovoltaic effect and electrical equivalent circuit of a PV cell, Dependence of a PV cell characteristic on temperature, solar cell output characteristics, flat plate and concentrating collectors, solar applications-solar heating/cooling technique, solar distillation, drying, street lighting, domestic lighting, solar PV pumping systems

### UNIT-II (9)

**Wind Energy:** Principles of wind power, evaluation of wind intensity, operation of a wind turbine and wind power curve, different types of wind turbine generators, topography and classification of wind turbines and its applications

**Geothermal Energy:** Origin and types of geothermal energy, operational difficulties, liquid dominated systems

### UNIT-III (9)

**Energy from Oceans:** Ocean temperature differences, ocean waves, energy from the waves, introduction of tidal power, basic principle of tidal power, components of tidal power plants

**Bioenergy:** Introduction, bio-mass conversion technologies, photo synthesis, biogas generation, biogas from power plant wastes, methods of maintaining biogas production, utilization of biogas, biogas gasification

## UNIT-IV (9)

**Chemical energy sources:** Introduction to fuel cells, principle of operation of fuel cell, classification of fuel cells, advantages, disadvantages and applications of fuel cells

**Types of energy storage systems**: Introduction, mechanical energy storage systems, batteries, ultra-capacitors, super conducting magnetic storage, applications

**Case study on present scenario of energy generation in India**

**Textbooks:**

[1] Rai G.D, *Non-Conventional Energy Sources*, 4th ed. New Delhi: Khanna Publishers, 2010.

**Reference books:**

[1] B.H. Khan, *Non-conventional Energy Resources*, 2nd ed. New Delhi: McGraw Hill Publishers, 2006.
[2] Felix A. Farret, M. Godoy Simoes, *Integration of Alternative Sources of Energy*, New York: John Wiley & Sons, 2006.
[3] Bansal N. K. Kaleeman and M. Miller, *Renewable Energy Sources and Conversion Technology*, New Delhi: Mc GrawHill Publishers, 2006.
[4] Duffie and Beckman, *Solar Energy Thermal Process*, New York: John Wiley & Sons, 2006.

**Course Learning Outcomes (COs)**:
Upon completion of this course, the student will be able to…

*CO1: compare conventional and non-conventional energy resources; describe solar cell characteristics and discuss applications of solar energy*
*CO2: compute power output of wind and describe principle of geothermal energy system*
*CO3: describe harnessing of electric power from oceans and biomass*
*CO4: describe principle of operation of fuel cells and list different types of energy storage systems*

**Course Articulation Matrix (CAM): P20OE302G RENEWABLE ENERGY SOURCES**

| CO | | PO 1 | PO 2 | PO 3 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| CO1 | **P20OE302G.1** | 2 | 1 | 1 | - | - |
| CO2 | **P20OE302G.2** | 2 | 1 | 1 | - | - |
| CO3 | **P20OE302G.3** | 2 | 1 | 1 | - | - |
| CO4 | **P20OE302G.4** | 2 | 1 | 1 | - | - |
| **P20OE302G** | | **2** | **1** | **1** | **-** | **-** |

## P20SC303 : DISSERTATION PHASE-I /INDUSTRIAL PROJECT

**Class:**M.Tech.III - Semester **Specialization:** Structural & Construction Engineering

**TeachingScheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 18 | 9 |

**ExaminationScheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 100 |
| End Semester Examination | -- |

**Course LearningObjectives (LOs)**:
This course will develop students' knowledge on /in…
*LO1: selecting problem-based Dissertation title in one of the areas of specialization*
*LO2: literature review and well-documented report writing*
*LO3: effective technical presentation skills with creating PPTs and speaking with technical knowledge*
*LO3: creating video pitch*

**Registration Presentation**: The Registration Dissertation Presentation shall include a brief report and presentation focusing the identified topic, literature review, time schedule indicating the main tasks, and expected outcome.

**Progress Presentation-I:** At the end of first stage (third semester), student shall be required to submit a preliminary report of work done for evaluation to the project coordinator and present the same before the *Department Post Graduate Review Committee* (DPGRC).

**Evaluation for Dissertation / Industrial Project:**

Dissertation work shall be normally conducted in two stages: Dissertation *Phase-I* in third semester and Dissertation *Phase-II* in fourth semester.

**Dissertation *Phase-I*:**

*(i)* The Department *Post Graduate Review Committee (DPGRC)* shall be constituted with HoD as a Chairman, M.Tech. Coordinator as a Convener and three to five other faculty members representing various specializations in that particular programme as members.

*(ii)* (a) Student shall take up independent Dissertation Phase-I on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their programme of study, which would supplement and complement the program assigned to each student

(or)

(b) Student shall take up industrial project (in any industry) relevant to the courses offered in their programme of study, which would supplement and complement the program assigned to each student

*(iii)* DPGRC shall allot a faculty supervisor to each student for guiding on

(a) Selection of topic

(b) Literature survey and 50% work to be carried out during phase-I

(c) Preparing a report in proper format

(d) Effective oral presentation on dissertation phase-I before the DPGRC

(e) Right conduct of research and academic activity to promote academic integrity

(f)Use of anti-plagiarism software to detect plagiarism in the report and submission of dissertation report within acceptable plagiarism levels

*(iv)* In case of students with industrial projects, internal guide shall be there to track the progress from time to time

*(v)* There shall be only Continuous Internal Evaluation (CIE) for Dissertation Phase-I

*(vi)* CIE for the Dissertation Phase-I in third semester is as follows:

| **Assessment** | **Weightage** |
|---|---|
| Dissertation Phase-I Supervisor Assessment | **50%** |
| DPGRC Assessment:<br>*(i) Registration Presentation* ***(10%)***<br>*(ii) Progress Report on Phase-I* ***(10%)***<br>*(iii) Video pitch on Phase-I* ***(10%)***<br>*(iv) Progress Presentation -I and viva voce* ***(20%)*** | **50%** |
| **Total Weightage:** | **100%** |

Note: It is mandatory for the student to

(i) appear for progress presentation -I and viva voceto qualify for course evaluation

(ii) create a good video pitch on dissertation phase-I

(a) **Dissertation Topic:** The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals/Technical Magazines on the topics of potential interest

(b) **Working Model:** Each student is required to develop a working model/ process/software package/system, on the chosen work and demonstrate before the DPGRC as per the dates specified by DPGRC at the end of dissertation phase-II

(c) **Progress Report:** Each student is required to submit a well-documented progress report on dissertation phase-I as per format specified by DPGRC

*(vii)* The student has to register for the Dissertation Phase-I as supplementary examination in the following cases:

(a) he/she is absent for oral presentation and viva-voce
(b) he/she fails to submit the report in prescribed format
(c) he/she fails to fulfill the requirements of Dissertation Phase-I evaluation as per specified guidelines

*(viii)* (a) The CoE shall send a list of students registered for supplementary to the HoDconcerned

(b)The DPGRC, duly constituted by the HoD, shall conduct Dissertation Phase-I evaluation and send the award list to the CoE within the stipulated time

**Course Learning Outcomes (COs)**:
On completion of this course, students will be able to…

*CO1: select current topics in their specialization and allied areas from peer reviewed journals / technical magazines/ conference proceedings*
*CO2: demonstrate the skills for performing literature survey, identify gaps, analyze the technical content and prepare a well-documented dissertation report*
*CO3: create informative ppts with effective oral presentation, showing knowledge on the subject and sensitivity towards social impact of the dissertation*
*CO4: demonstrate dissertation through effective video pitch*

| **Course Articulation Matrix (CAM): P20SC303DISSERTATION PHASE-I /INDUSTRIAL PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO 1** | **PSO 2** |
| CO1 | **P20SC303.1** | 2 | - | 2 | 2 | 2 |
| CO2 | **P20SC303.2** | 2 | - | 2 | 2 | 2 |
| CO3 | **P20SC303.3** | - | 2 | - | 1 | 1 |
| CO4 | **P20SC303.4** | - | 2 | - | 1 | 1 |
| **P20SC303** | | **2** | **2** | **2** | **1.5** | **1.5** |

## P20SC304 : INTERNSHIP EVALUATION

**Class:**M.Tech.III - Semester **Specialization:** Structural & Construction Engineering

**TeachingScheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 18 | 9 |

**ExaminationScheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 100 |
| End Semester Examination | -- |

**Course LearningObjectives (LOs)**:
This course will develop students' knowledge on /in…
*LO1: selection of internship in one of the areas of course specialization*
*LO2: practical and real time subject application*
*LO3: writing well-documented report*
*LO4: effective technical presentation skills with creating PPTs*

**Guidelines for Internship:**

(1) The students shall undergo 6-8 weeks internship during summer/winter vacation at industry/R&D organization / Academic Institutes like IITs & NITs.

(2) The students preferably shall undergo internship at one organization only. In case of any difficulty, the stipulated period of internship shall be completed at different organizations with minimum of two weeks internship at every stage.

(3) The internship evaluation shall be done in the III semester of study and hence the students shall complete the prescribed period of internship before start of III semester (from end of I semester to commencement of III semester).

(4) The internship evaluation shall be done by *Department Post Graduate Evaluation Committee (DPGRC)*.

**Evaluation for Internship:**

There shall be only Continuous Internal Evaluation (CIE) for Internship Evaluation

*(ix)* CIE for the Internship in third semester is as follows:

| Assessment | Weightage |
|---|---|
| Internship Supervisor's Evaluation:<br>*a) Completion of Internship Assignment* ***(10%)***<br>*b) Quality of work in completing the Internship Assignment* ***(10%)***<br>c) *Attendance, punctuality and work hours* ***(10%)*** | ***30%*** |

| | |
|---|---|
| DPGRC Assessment:<br>*a) Duration (8 /6 weeks)* ***(15% / 10%)***<br>*b) Internship Report* ***(35%)***<br>*c) Oral Presentation (with PPT) and viva voce* ***(20%)*** | ***70%*** |
| **Total Weightage:** | ***100%*** |

Note: It is mandatory for the student to

(i) appear for oral presentation (with PPT) and viva voceto qualify for course evaluation

**(a) Internship Report:** Each student is required to submit a well-documented internship report as per format specified by DPGRC

**(b) Anti-Plagiarism Check:** The internship report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

**(c) Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the DPGRCas per the schedule notified by thedepartment

*(x)* The student has to register for the Internship as supplementary examination in the following cases:

(a) he/she is absent for oral presentation and viva-voce

(b) he/she fails to submit the report in prescribed format

(c) he/she fails to fulfill the requirements of Internship evaluation as per specified guidelines

*(xi)* (a) The CoE shall send a list of students registered for supplementary to the HoD concerned

(b) The DPGRC, duly constituted by the HoD, shall conduct Internship evaluation and send the award list to the CoE within the stipulated time

**Course Learning Outcomes (COs)**:

On completion of this course, students will be able to…

*CO1: learn new concepts and apply them to the solution of engineering problems*

*CO2: function effectively on multidisciplinary teams and interface with other areas of organization*

*CO3: clearly communicate their ideas in writing and prepare a well-documented internship report*

*CO4: create informative PPTs and clearly communicate their ideas orally demonstrating technical knowledge*

| Course Articulation Matrix (CAM): P20SC304 : INTERNSHIP EVALUATION | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO 1** | **PSO 2** |
| CO1 | **P20SC304.1** | 2 | - | 2 | 2 | 2 |
| CO2 | **P20SC304.2** | 2 | - | 2 | 2 | 2 |
| CO3 | **P20SC304.3** | - | 2 | - | 1 | 1 |
| CO4 | **P20SC304.4** | - | 2 | - | 1 | 1 |
| **P20SC304** | | **2** | **2** | **2** | **1.5** | **1.5** |

**PRR-20**

**HEME OF INSTRUCTION & EVALUATION FOR TWO YEAR POSTGRADUATE PROGRAMME**

## M.TECH. (STRUCTURAL AND CONSTRUCTION ENGINEERING)

## SEMESTER-IV

| Sr. No. | Course Type | Course Code | Course Name | Teaching scheme | | | Credits | Evaluation Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | CIE - TA | | | | | | | ESE | Total Marks |
| | | | | | | | | I²RE | | | | Minor | MSE | Total | | |
| | | | | | | | | ATLP | CRP | CP | PPT | | | | | |
| 1 | PROJ | P20DC401 | Dissertation Phase - II | - | - | 30 | 15 | - | - | - | - | - | - | 60 | 40 | 100 |
| | | | Total: | - | - | 30 | 15 | | | | | | | 60 | 40 | 100 |

**[L= Lecture, T = Tutorials, P = Practicals, C = Credits, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]**

**Total Contact Periods/Week: 30** **Total Credits: 15**

## P20SC401 : DISSERTATION PHASE-II

**Class:**M.Tech.IV - Semester **Specialization:** Structural & Construction Engineering

**TeachingScheme:**

| L | T | P | C |
|---|---|---|---|
| - | - | 30 | 15 |

**ExaminationScheme:**

| | |
|---|---|
| Continuous Internal Evaluation | 60 |
| End Semester Examination | 40 |

**Course LearningObjectives (LOs)**:
This course will develop students' knowledge on /in…

*LO1: recognize and formulate a problem to analyze, synthesize, evaluate, simulate and create their project*

*LO2: design an innovative product by applying current knowledge and adopt to emergingapplications of engineering and technology*

*LO3: creating PPTs and effective technical presentation and knowledge skills*

*LO4: writing technical paper in scientific journal style & format*

**Progress Presentation -II** shall be conducted during the 5th /6th week of IV semester.
**Progress Presentation -III** shall be conducted during the 12th /13th week of IV semester.

**Evaluation for Dissertation Work:**

**Dissertation *Phase-II*:**

*(i)* Student has to continue the Dissertation work in 4th semester as Dissertation Phase-II

*(ii)* There shall be Continuous Internal Evaluation (CIE) for 60 marks and End Semester Examination for 40 marks.

*(iii)* The evaluation for Dissertation Phase-II is as follows:

| Assessment | Weightage |
|---|---|
| Dissertation Supervisor Assessment (10%)<br>*DPGRC* Assessment:<br>*(i) Progress Presentation -II (10%)*<br>*(ii) Progress Presentation -III (10%)*<br>*(iii) Working model/process/software package/system developed (10%)*<br>*(iv) Dissertation Video pitch (10%)*<br>*(v) Dissertation Paper (10%)* | **60%** |
| End Semester Examination:<br>*(i) Dissertation Report (20%)*<br>*(ii) Oral presentation with PPT andviva-voce (20%)* | **40%** |
| **Total Weightage** | **100%** |

Note: It is mandatory for the student to

(i) appear for oral presentation (with PPT) andviva-voce to qualify for course evaluation

(ii) write dissertation paper in given journal format

(ii) create a good video pitch on dissertation phase-I & II

(a) **Working Model:** Each student is required to develop a working model/ process/system on the chosen work and demonstrate before the DPGRC as per the dates specified by DPGRC at the end of dissertation phase-II

(b) **Dissertation Report:** Each student is required to submit a well-documented dissertation report as per the format specified by DPGRC

(c) **Anti-Plagiarism Check:** The dissertation report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(d) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the DPGRC as per the schedule notified by the department

(e) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her dissertation Phase-I & II. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (if any) and social impact

***(iv)*** **Dissertation Synopsis Presentation (DSP):**

(a) Students, with the consent of supervisor, shall apply to the DPGRC for conduct of dissertation synopsis presentation (DSP). This shall normally happen when the supervisor feels that the student has done significant work to qualify for M.Tech. dissertation.

(b) Those students who clear DSP shall only be allowed to submit the dissertation report for end semester examination

***(v)*** **Dissertation Report:**

After clearing DSP, student shall be required to submit two bound copies of dissertation report, one for the department and other for the Dissertation Supervisor. The Dissertation report shall be evaluated by the DPGRC and external examination shall be conducted on a pre-notified date.

**Course Learning Outcomes (COs)**:

On completion of this course, students will be able to…

*CO1: apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models / process / system leading to innovation and entrepreneurship*

*CO2: design the hardware/software to demonstrate the principle of working to correlate the analytical simulation and experimental results*

*CO3: create informative PPT and demonstrate communication skills through effective oral presentation showing knowledge on the subject and sensitivity towards social impact of the Dissertation*

*CO4: write a "Dissertation paper" in scientific journal style and format from the prepared Dissertation report and create a video pitch on Dissertation*

| **Course Articulation Matrix (CAM): P20SC401DISSERTATION PHASE-II** | | | | | | |
|---|---|---|---|---|---|---|
| **CO** | | **PO 1** | **PO 2** | **PO 3** | **PSO 1** | **PSO 2** |
| CO1 | **P20SC401.1** | 2 | - | 2 | 2 | 2 |
| CO2 | **P20SC401.2** | 2 | - | 2 | 2 | 2 |
| CO3 | **P20SC401.3** | - | 2 | - | 1 | 1 |
| CO4 | **P20SC401.4** | - | 2 | - | 1 | 1 |
| **P20SC401** | | **2** | **2** | **2** | **1.5** | **1.5** |

## COURSE CREDIT STRUCTURECOURSE WEIGHTAGE

| Semester | PRR-20 Curriculum | As per Model Curriculum |
|---|---|---|
| **I** | 19 | 18 |
| **II** | 19 | 18 |
| **III** | 15 | 16 |
| **IV** | 15 | 16 |
| **Total:** | **68** | **68** |

| Courses | % Weightage ofCourses |
|---|---|
| Professional Theory | 42.85 % (9/21) |
| Professional Lab | 38.1 % (8/21) |
| Other | 19.05 % (4/21) |
| **Total:** | **100 % (21/21)** |

## SEMESTER vs COURSE CATEGORY WEIGHTAGE

Number of Courses / Number of Credits (*Course Category wise*)

| Semester | MC | PC | PE | OE | PROJ | AC | TOTAL |
|---|---|---|---|---|---|---|---|
| **I** | 1/2 | 4/10 | 2/6 | - | - | 1/1 | **8/19** |
| **II** | - | 4/10 | 2/6 | - | 1/2 | 1/1 | **8/19** |
| **III** | - | - | 1/3 | 1/3 | 2/9 | - | **4/15** |
| **IV** | - | - | - | - | 1/15 | - | **1/15** |
| **Total** | **1/2** | **8/20** | **5/15** | **1/3** | **4/26** | **2/2** | **21/68** |
| **% Weightage of Course Category** | **2.94 % (2/68)** | **29.41 % (20/68)** | **22.05 % (15/68)** | **4.41 % (3/68)** | **38.23 % (26/68)** | **2.94 % (2/68)** | **100 % (68/68)** |