MVJ College of Engineering, Bengaluru
(An Autonomous Institute)
Affiliated to VTU, Belagavi, Approved by AICTE, New Delhi,
Recognised by UGC with 2(f) & 12 (B), Accredited by NBA & NAAC

Department of CIVIL ENGINEERING

About Department

The Department offers a UG programme, two PG programmes (M.Tech in Structural Engineering and Transportation Engineering) which are approved by AICTE and affiliated to Visvesvaraya Technological University, Belgaum, recognized by Government of Karnataka. Since its inception in 1982, faculty with good blend of experience in Research, Industry and Academia are actively involved in research and academic activities (the h-index of the department is 7). The department has established state of art research and academic laboratories. Apart from curriculum, students are actively involved in research activities, in-house projects and internships. They also take part in inter collegiate activities conducted by other colleges. "SHRUSTI" a departmental club organizes technical events to encourage students to showcase their talents in co-curricular activities.

VISION:

To prepare skilled professionals in Civil engineering technology, who move towards making a more sustainable and socially responsible future.

MISSION:

- **Optimal environment for Lifelong learning:** To create Civil engineers by creating and maintaining an optimal teaching and learning environment in which faculty grow professionally and students receive unsurpassed knowledge skills, insights and the tools for lifelong learning in their respective disciplines.
- **Enhancing classroom Approaches:** To provide ample classroom teaching and practical sessions and enable the students to learn technology effectively.
- **Periodic interactions with industry:** To expose the students to latest technology and industrial practices through industrial interactions.
- **Value based Education:** To make socially responsible professionals through value based education.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: Professional development: They will be successful professional working in government or Private organizations as Civil Engineers.

PEO2: Lifelong learning: Graduates will innovate and follow sustainable practices in Civil Engineering.

PEO3: Higher Education: Graduates will pursue higher education that is adaptive to changing needs of profession in community.

PROGRAM SPECIFIC OBJECTIVES

PSO1: Analysis and Design: The program demonstrates the analysis and design of Structural, Geotechnical, Transportation and Environmental Engineering system.

PSO2: Modern Tools: The program demonstrates modern computational methods applied to Civil Engineering.

PROGRAMME OUTCOMES

PO1: Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and life – long learning in the broadcast context of technological change.

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Department of Structural Engineering

Scheme of Teaching and Examination 2019-20

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2019-20)

I SEMESTER M.Tech

S No	Course and Course code		Course Title	Teaching Department	Teaching hours/week		Total Marks				Credits
					Theory Lecture	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total marks	
					L	P					
1	PCC	MVJ19CSE11	Advanced Design of RC Structures	CSE	4	-	3	50	50	100	4
2	PCC	MVJ19CSE12	Mechanics of Deformable Bodies	CSE	4	-	3	50	50	100	4
3	PCC	MVJ19CSE13	Structural Dynamics	CSE	4	-	3	50	50	100	4
4	PCC	MVJ19CSE14	Special Concrete	CSE	4	-	3	50	50	100	4
5	PCC	MVJ19IPR15	Intellectual Property Rights	CSE	2	-	3	50	50	100	2
6	PCC	MVJ19CSEL16	Advanced Concrete Lab	CSE	1	2	3	50	50	100	2
7	PCC	MVJ19CSEL17	Structural Software Lab-1	CSE	1	2	3	50	50	100	2
				Total	**18**	**6**	**21**	**350**	**350**	**700**	**22**
Note: PCC: Professional Core.											

II SEMESTER M.Tech

S No	Course and Course code		Course Title	Teaching Department	Teaching hours/week		Total Marks				Credits
					Theory Lecture	Practical/Drawing	Duration in Hours	CIE Marks	SEE Marks	Total marks	
					L	P					
1	PCC	MVJ19CSE21	Advanced Design of Steel Structures	CSE	4	-	3	50	50	100	4
2	PCC	MVJ19CSE22	Finite Element Method of Analysis	CSE	4	-	3	50	50	100	4
3	PCC	MVJ19CSE23	Earthquake Resistance Structures	CSE	4	-	3	50	50	100	4
4	PEC	MVJ19CSE24X	Professional Elective-1	CSE	3	-	3	50	50	100	3
5	PEC	MVJ19CSE25X	Professional Elective-2	CSE	3	-	3	50	50	100	3
6	OEC	MVJ19CSE26X	Open Elective	XX	3	-	3	50	50	100	3
7	PCC	MVJ19CSEL27	Structural Engineering Lab-2	CSE	-	3	3	50	50	100	2
8	PCC	MVJ19CSE28	Mini Project	CSE	-	2	-	100	-	100	2
				Total	**21**	**5**	**21**	**450**	**350**	**800**	**25**

Note: PCC: Professional Core, PEC: Professional Elective, OEC: Professional Open Elective.

Note: Students has to undergo Two CERTIFICATION COURSE : 2 CREDITS Between 2nd and 3rd Semester

Note:

1. Mini Project: All the students shall have to Perform Mini Project in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Mini Project work. Mini Project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the Mini Project shall be declared as failed and have to complete during the subsequent University examination after satisfying the Project requirements.

Professional Elective-1		Professional Elective-2		Open Elective	
MVJ19CSE241	Advanced Design of Pre-stressed Concrete Structures	MVJ19CSE251	Advanced Structural Analysis	MVJ19CSE261	Sustainable Concepts in Engineering
MVJ19CSE242	Stability of Structures	MVJ19CSE252	Design of High Rise Structures	MVJ19CSE262	Remote Sensing and GIS
MVJ19CSE243	Design of Precast & Composite Structures	MVJ19CSE253	Design of Industrial Structures	MVJ19CSE263	Occupational Health and Safety
MVJ19CSE244	Reliability Analysis of Structures	MVJ19CSE254	Structural Health Monitoring		

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III SEMESTER M.Tech

S No	Course and Course code		Course Title	Teaching Department	Teaching hours/week		Total Marks				Credits
					Theory Lecture	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total marks	
					L	P					
1	PCC	MVJ19CSE31	Design of Concrete Bridges	CSE	4	-	3	50	50	100	4
2	PEC	MVJ19CSE32X	ProfessionalElective-3	CSE	3	-	3	50	50	100	3
3	PEC	MVJ19CSE33X	ProfessionalElective-4	CSE	3	-	3	50	50	100	3
4	Project	MVJ19CSE34	Technical Seminar	CSE	-	2	-	100	-	100	2
5	Seminar	MVJ19CSE35	Evaluation of Project Phase-1	CSE	-	2	-	100	-	100	2
6	Internship	MVJ19CSE36	Internship	CSE	(Completed during the intervening vacation of III and IV semesters)		3	50	50	100	6
				Total	**10**	**4**	**12**	**400**	**200**	**600**	**20**

Note: PCC: Professional Core, PEC: Professional Elective.

Note:

1. Project Phase-1: Students in consultation with the guide/co-guide if any shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HOD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1 shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. SEE (University examination) shall be as per the University norms.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation for 10 Weeks. Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent
University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

3. Technical Seminar: CIE marks shall be awarded by a committee comprising of HOD as Chairman, Guide/co-guide, if any, and a senior

faculty of the department. Participation in the seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory.

The CIE marks awarded for Technical Seminar shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.

Professional Elective-3		Professional Elective-4	
MVJ19CSE321	Design Concepts of Substructures	MVJ19CSE331	Fracture Mechanics applied to concrete
MVJ19CSE322	Repair and Rehabilitation of Structures	MVJ19CSE332	Design of Masonry Structures
MVJ19CSE323	Theory of Plates and Shells	MVJ19CSE333	Design of Formwork

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IV SEMESTER M.Tech

S No	Course and Course code		Course Title	Teaching Department	Teaching hours/week		Total Marks				Credits
					Theory Lecture	Practical/Drawing	Duration in Hours	CIE Marks	SEE Marks	Total marks	
					L	P					
1	Project	MVJ19CSE42	Project Work Phase -2	CSE	-	4	3	50	50	100	19
				Total	**-**	**4**	**3**	**50**	**50**	**100**	**19**

Note: PCC: Professional Core.

Note:

1. Project Phase-2:

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

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ADVANCED DESIGN OF RC STRUCTURES

Course Code	MVJ19CSE11	**CIE**	50
No. of Contact hours / Week	04	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**04**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principle of structural design
- To design different types of structures and to detail the structures.
- To evaluate the performance of structures

Modules	RBT Level	Hrs
Module-1		
Basic Design Concepts: Limit state of Serviceability: Deflections of Reinforced concrete beams and slabs, short term deflection and long term deflection, estimation of crack width in RCC members, calculation of crack widths.	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-2		
Limit Analysis of R.C. Structures: Yield line analysis for slabs: Upper bound and lower bound theorems – yield line criterion – Virtual work and equilibrium methods of analysis for square and circular slabs with simple and continuous end conditions.	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-3		
Design of Flat slabs: Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears – Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-4		
Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels , Design of Procedure of Corbels.	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-5		

Design of Elevated intz type of Water Tank, Design of silos and bunkers.	**L1, L2, L3, L4, L5**	**10 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Design
CO3: Design and develop analytical skills.
CO4: Summarize the principles of Structural Design and detailing
CO5: Understands the structural performance.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Park A and Paulay, *"Reinforced and Prestressed Concrete"*, John Wiley & sons,1st Edition, 2010.
2. Kong K F and Evans T H, *"Reinforced and Prestressed Concrete"*, CRC Press,3rd Edition ,2013.
3. Varghese P.C., *"Advanced Reinforced Concrete Design II Ed"*, Prentice-Hall of India, New Delhi,2nd Edition, 2005.
4. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, *"Comprehensive RCC Design"*, Laxmi Publications,10th Edition 2015.
5. Bungey and Mosley, *"Reinforced Concrete"*, Palgrave Macmillan, 5th Edition, 2012.

Web Link and Video Lectures:

1. https://nptel.ac.in/courses/105105105/

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MECHANICS OF DEFORMABLE BODIES

Course Code	MVJ19CSE12	**CIE**	50
No. of Contact hours / Week	04	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**04**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principles of Analysis of Stress and Strain
- To predict the stress-strain behaviour of continuum
- To evaluate the stress and strain parameters and their inter relations of the continuum

Modules	RBT Level	Hrs
Module-1		
Theory of Elasticity: Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint of Cartesian and polar coordinates, Octahedral stresses, Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases, Generalized Hooke's law.	**L1, L2**	**10 Hrs**
Module-2		
Transformation of stress and strain at a point, Principal stresses and principal strains, invariants of stress and strain, hydrostatic and deviatric stress, spherical and deviatric strains max. shear strain.	**L2, L3**	**10 Hrs**
Module-3		
Plane stress and plane strain: Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams. Solution of axisymmetric problems, stress concentration due to the presence of a circular hole inplates.	**L2, L3**	**10 Hrs**
Module-4		
Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations inelasticity.	**L2, L3, L4**	**10 Hrs**
Module-5		

Theory of Plasticity: One-dimensional elastic-plastic relations, isotropic and kinematic hardening,yield function, flow rule, hardening rule, incremental stress-strain relationship, governing equations ofelastoplasticity, Yield and failure criteria-Stress strain relations for perfect elasto-plastic materials-Von Mises, Tresca and Mohr-Coulomb stress functions-simple elastic plastic problem-Expansion of a thick walled cylinder – incremental stress-strainrelationship Implementation of plasticity in metals and concrete – principles only – metals - plastic stress strainmatrix for metals- nonlinear stress strain relation in concrete..	**L1, L2**	**10 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of stress-strain behaviour of continuum
CO3: Design and develop analytical skills.
CO4: Describe the continuum in 2and 3-dimensions
CO5: Understand the concepts of elasticity and plasticity .

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Timoshenko &Goodier, *"Theory of Elasticity",* McGraw Hill,3rd Edition, 2017
2. Srinath L.S., *Advanced Mechanics of Solids*, , Tata McGraw Hill Publishing company, New Delhi, 10th Edition,1994.
3. Sadhu Singh, *"Theory of Elasticity",* Khanna Publishers, 2nd Edition, 2015
4. Verma P.D.S, *"Theory of Elasticity*", Vikas Publishing Pvt. Ltd, 2nd Edition, 2012
5. Chenn W.P and Hendry D.J, *"Plasticity for Structural Engineers*", Springer Verlag,5th Edition 2007.
6. Valliappan C, "*Continuum Mechanics Fundamentals*", Oxford IBH Publishing Co.Ltd, 1st Edition 2016.
7. Xi Lu, "*Theory of Elasticity*", John Wiley, 9th Edition 2002

Web Link and Video Lectures:

1. https://nptel.ac.in/courses/105104160/

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STRUCTURAL DYNAMICS

Course Code	MVJ19CSE13	**CIE**	50
No. of Contact hours / Week	04	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**04**	**Exam. Duration**	3 Hrs

Course Objectives

- To learn principles of Structural Dynamics
- To implement these principles through different methods and to apply the same for free and forced vibration of structures
- To evaluate the dynamic characteristics of the structures

Modules	RBT Level	Hrs
Module-1		
Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, Basic Definition vibration of SDOF (Single Degree of Freedom) Systems , Damped, UnDamped, Free Vibrations equivalent Viscous damping, Logarithmic decrement. Mathematical models of Single-degree-of-freedom systems	**L1, L2, L5**	**10 Hrs**
Module-2		
Response of Single-degree-of-freedom systems to harmonic loading including support motion, vibration isolation, transmissibility. **Principle of vibration measuring instruments**–seismometer and accelerometer.	**L3, L4, L5,**	**10 Hrs**
Module-3		
Dynamics of Multi-degree freedom systems: Mathematical models of multi-degree-of-freedom systems, Shear building. concept, free vibration of un damped multi-degree-of-freedom systems–Natural frequencies and mode shapes – Orthogonality of modes.	**L1, L2, L4, L5**	**10 Hrs**
Module-4		

Response of Shear buildings for harmonic loading without damping using normal mode approach. Response of Shear buildings for forced vibration for harmonic loading with damping using normal modal approach.	**L3, L4, L5**	**10 Hrs**
Module-5		
Approximate methods: Rayleigh's method, Dunarley's method, Stodola's method. Dynamics of Continuous systems: Flexural vibration of beams with different end conditions.	**L2, L4**	**10 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Dynamics
CO3: Design and develop analytical skills .
CO4: Summarize the Solution techniques for dynamics of Multi-degree freedom systems
CO5: Understand the concepts of damping in structures .

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Mukhopadhaya M , "*structural dynamics Vibrations*" Oxford IBH, 2nd Edition 2014.
2. Mario Paz "*Structural Dynamics*" CBS publishers,5th Edition 2004
3. Clough & Penzi "*Structural Dynamics*" en: TMH,2nd Edition 2018
4. Timoshenko S, Van-Nostrand "*Vibration Problems in Engineering*" C, th Edition 2006
5. Anil K. Chopra, Dynamics of Structures – "*Theory and Application to Earthquake Engineering*", Pearson Education,2nd Edition 2015
6. Vinod Hosur, WILEY "*Earthquake Resistant Design of Building Structures*" (India),2nd Edition 2014

Web Link and Video Lectures:

1. https://nptel.ac.in/courses/105101006/

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SPECIAL CONCRETE

Course Code	MVJ19CSE14	**CIE**	50
No. of Contact hours / Week	04	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**04**	**Exam. Duration**	3 Hrs

Course Objectives

- Provides a comprehensive treatment of the constituent materials of concrete
- Learn the principles of Concrete mix design, and assess the performance of various cement-based materials including normal and high strength concrete as well as special cement composite
- To differentiate between different types of concrete and learn characterize and predict the behaviour of special concrete

Modules	RBT Level	Hrs
Module-1		
Constituent materials: Role of constituents, Components of modern concrete, Rheology, Mineral and Chemical admixtures and their effect on properties of concrete. **Special cements:** Need, Classifications, Blended cements, modified hydraulic cements, calcium aluminate cements, calcium sulphate based binders, calcium sulfo aluminate cements, shrinkage compensating (or) expansive cements, macro defect-free cements, phosphate cements, fast setting cements, their Performance and prescriptive specifications, Methods of mix proportioning: IS method, ACI method and BS method	**L1, L2, L4**	**8 Hrs**
Module-2		
Ferro cement: Materials, mechanical properties, cracking of ferrocement, Types and methods of construction, strength and behaviour in tension, compression and flexure, Design of ferrocement in tension, durability, and applications. **High density concrete:** Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state**,** placement methods. **Self-compacting Concrete (SCC):** General characteristics,	**L1, L2, L5,**	**8 Hrs**

Properties, microstructure. robustness. applications.		
Module-3		
Other concretes for special properties: High-volume fly ash concretes, geo-polymer concrete, pervious concrete, aerated concrete, Reactive powder concrete, Bacterial concrete, Heat resistant and refractory concrete. Their significance, materials, general consideration strength and durability aspects. Mixture proportioning and parameters in the development of Special concreting operations: Pre-placed aggregate, anti-washout concretes, concrete pumping, tremie placement for underwater applications.	**L1, L2, L5**	**8 Hrs**
Module-4		
Special Concretes: Sulfur Concrete, Concrete made with waste rubber, Geo synthetics, Nano Concrete, Changes in concrete with respect to time. **High strength concretes:** Materials and mix proportion, Microstructure, stress-strain relation, fracture, drying shrinkage, and creep. **Mass concrete and Roller compacted concrete:** Constituents, mix proportioning, properties in fresh andhardened states, applications and limitations.	**L1, L2, L4**	**8 Hrs**
Module-5		
Repair principles, materials and corrosion control measures: Patches, overlay, repair mortars, sprayed concrete, FRP wrapping, corrosion, inhibitors, surface coatings and cathodic protection, Industrial waste materials in concrete Rapid wall panels Sustainable & durable construction, Quality control and quality assurance during production/construction	**L1, L2, L3**	**8 Hrs**

Course outcomes:

CO1: Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy

CO2: Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete for special properties.

CO3: Design and develop analytical skills .

CO4: Understand the concepts, mix proportioning and methods of special concreting operations.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1) Santhakumar R, (2007) "*Concrete Technology*"-Oxford University Press, New Delhi,3rd Edition, 2007.

2) Short A and Kinniburgh.W, "*Light Weight Concrete*"- Asia Publishing House,3rd Edition 1978.
3) Aitcin P.C. "*High Performance Concrete*"-E and FN, Spon London, 2nd Edition 2004.
4) Rixom.R. and Mailvaganam.N., "*Chemical admixtures in concrete*"- E and FN, Spon, London, 2nd Edition 2000
5) Rudnai.G., "*Light Weight concrete*"-Akademiaikiado, Budapest,5th Edition, 2006.

Web Link and Video Lectures:

1) http://qcin.org/CAS/RMCPC/

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INTELLECTUAL PROPERTY RIGHTS

Course Code	MVJ19IPR15	**CIE**	50
No. of Contact hours / Week	02	**SEE**	50
Total No. of Contact	25	**Total**	100
Credits	**02**	**Exam. Duration**	3 Hrs

Course Objectives

- To give an overview of the research methodology and explain the technique of defining a research problem
- To explain the functions of the literature review in research.
- To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- To explain various research designs and their characteristics.
- To explain the details of sampling designs, and also different methods of data collections.
- To explain the art of interpretation and the art of writing research reports.
- To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment.

To discuss leading International Instruments concerning Intellectual Property Rights.

Modules	RBT Level	Hrs.
Module-1		
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.	**L1, L2,L3**	**10 Hrs**
Module-2		
Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An	**L1, L2,L3**	**11 Hrs**

Illustration. **Reviewing the literature:** Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.		
Module-3		
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **Design of Sample Surveys:** Introduction, Sample Design, Sampling and Non- sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.	**L1, L2,L3**	**11 Hrs**
Module-4		
Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. **Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout	**L1, L2,L3**	**10 Hrs**
Module-5		
Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World	**L1, L2,L3**	**08 Hrs**

Intellectual Property Organization (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.		

Course outcomes After the completion of the course students should be

CO1:. Discuss research methodology and the technique of defining a research problem

CO2:. Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.

CO3:. Explain various research designs and their characteristics.

CO4:. Explain the art of interpretation and the art of writing research reports

CO5:. Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Pandey Neeraj &Dharni Khushdeep, "I*ntellectual Property Rights"*, PHI Learning Pvt Ltd 5th Edition,2014.

2. Richard A. Spinello & Tavani H, "I*ntellectual Property Rights*", Information Science Publishing, 2nd Edition, 2004.

3 Roger D. Blair, Thomas F. Cotter "*Intellectual Property Rights*", Cambridge University Press, 3rd Edition, 2005.
Web Link and Video Lectures: 1. http://nptel.ac.in

I Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

ADVANCED CONCRETE LAB

Course Code	MVJ19CSEL16	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	42	**Total**	100
Credits	**02**	**Exam. Duration**	3 Hrs

Course Objectives

- To learn principles of design of experiments.
- To investigate the performance of structural elements
- Use of Nondestructive testing (NDT) equipments –Rebound hammer, Ultra sonic pulse velocity meter and Profometer

Modules	RBT Level	Hrs
1. Experiments on Concrete, including Mix design **2. Testing of beams for deflection, flexure and shear** **3. Use of Non-destructive testing (NDT) equipments –Rebound hammer, Ultra sonic pulse velocity meterand Profometer**	**L1, L2, L4, L5, L6**	**3 Hrs**

Course outcomes:
CO1: Achieve Knowledge of design and development of experimenting skills.
CO2: Understand the principles of design of experiments
CO3: Design and develop analytical skills.
CO4: Summarize the testing methods and equipments.

Question paper pattern:

- The question paper will have two questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions from each part.
- The students will have to answer 2 full questions, and record consists of 10 marks.

Web Link and Video Lectures:
2) https://www.youtube.com/watch?v=sl0smPfvVAo
3) https://www.youtube.com/watch?v=tlE3eK0g6vU

I Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

STRUCTURAL SOFTWARE LAB-1

Course Code	MVJ19CSEL17	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	42	**Total**	100
Credits	02	**Exam. Duration**	3 Hrs

Course Objectives

- To analyze the structure using FEM based Software.
- To learn principles of design.
- To investigate the performance of structural elements.
- To design the structural components using excel sheets.

Modules	RBT Level	Hrs
1. Static and Dynamic analysis and design of Multi-storey Building structures using any FE based software 2. Design of RCC and Steel Tall structures using any FE based software 3. Analysis of folded plates and shells using any FE software. 4. Preparation of EXCEL sheets for structural design	**L1, L2, L4, L5, L6**	**3 Hrs**

Course outcomes:
CO1: Achieve Knowledge of design and development of programming skills.
CO2: Understand the principles of structural analysis and design
CO3: Design and develop analytical skills.
CO4: Summarize the performance of structures for static and dynamic forces.

Question paper pattern:

- The question paper will have two questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions from each part.
- The students will have to answer 2 full questions, and record consists of 10 marks.

Web Link and Video Lectures:

1. **https://www.csiamerica.com/products/etabs**

2. **https://www.youtube.com/watch?v=LOtuwW9-G68**

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

ADVANCED DESIGN OF STEEL STRUCTURES

Course Code	MVJ19CSE21	**CIE**	50
No. of Contact hours / Week	04	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**04**	**Exam. Duration**	3 Hrs

Course Objectives

- Understand the background to the design provisions for hot-rolled and cold-formed steel structures, including the main differences between them. To design different types of structures and to detail the structures.
- Proficiency in applying the provisions for design of columns, beams, beam-columns
- Design structural sections for adequate fire resistance

Modules	RBT Level	Hrs
Module-1		
Laterally Unrestrained Beams: Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discrete lateral restraints, Mono- symmetric and non- uniform beams – Design Examples. Concepts of -Shear Center, Warping, Uniform and Non-Uniform torsion.	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-2		
Beam- Columns in Frames: Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns-, Methods in IS 800 - Examples	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-3		
Steel Beams with Web Openings: Shape of the web openings, practical guide lines, and Force distribution and failure patterns, Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties, Vierendeel girders (design for given analysis results)	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-4		

Cold formed steel sections: Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions- numerical examples, beam design, column design.	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-5		
Fire resistance: Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance ratings- Numerical Examples.	**L1, L2, L3, L4, L5**	**10 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Design
CO3: Design and develop analytical skills.
CO4: Summarize the principles of Structural Design and detailing
CO5: Understands the structural performance.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

6. N. Subramanian, "Design of Steel Structures", Oxford,IBH
7. Duggal.S.K., Design of Steel structures.
8. Srinath. L.S., Advanced Mechanics of Solids, Tata McGraw-Hill Publishing Co ltd., New Delhi 3. IS 1641, 1642,1643
9. IS 800: 2007, IS 811
10. INSDAG Teaching Resource Chapter 11 to 20

Web Link and Video Lectures:

1. www.steel-insdag.org

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Finite Element Method of Analysis

Course Code	MVJ19CSE22	**CIE**	50
No. of Contact hours / Week	04	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**04**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principles of Analysis of Stress and Strain
- To predict the stress-strain behaviour of continuum
- To evaluate the stress and strain parameters and their inter relations of the continuum

Modules	RBT Level	Hrs
Module-1		
Basic concepts of elasticity – Kinematic and Static variables for various types of structural problems – approximate method of structural analysis – Rayleigh – Ritz method – Finite difference method – Finite element method. Variation method and minimization of Energy approach of element formulation. Principles of finite element method – advantages & disadvantages – Finite element procedure. Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements – Numbering of nodes to minimize band width.	**L1, L2**	**10 Hrs**
Module-2		
Nodal displacement parameters – Convergence criterion – Compatibility requirements – Geometric invariance – Shape function – Polynomial form of displacement function. Generalized and Natural coordinates – Lagrangian interpolation function – shape functions for one, two & three dimensional elements.	**L1, L2, L4, L5**	**10 Hrs**
Module-3		
Isoparametric elements, Internal nodes and higher order elements, Serendipity and Lagrangian family of Finite Elements, Sub-parametric and Super- parametric elements, Condensation of internal nodes, Jacobian transformation Matrix. Development of strain-displacement matrix and stiffness matrix, consistent load	**L1, L2, L4, L5**	**10 Hrs**

vector, numerical integration. .		
Module-4		
Application of Finite Element Method for the analysis of one & two dimensional problems, Analysis of simple beams and plane trusses, Application to plane stress / strain / axisymmetric problems using CST & Quadrilateral Elements	**L1, L2, L3, L4, L5**	**10 Hrs**
Module-5		
Application to Plates & Shells, Choice of displacement function (C0, C1 and C2 type), Techniques for Non – linear Analysis.	**L1, L2**	**10 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of stress-strain behaviour of continuum
CO3: Design and develop analytical skills.
CO4: Describe the state of stress in a continuum
CO5: Understand the concepts of elasticity and plasticity .

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Krishnamoorthy C S, "Finite Element Analysis"- Tata McGraw Hill
2. Desai C and Abel J F, "Introduction to the Finite Element Method"- East West Press Pvt. Ltd., 1972
3. Bathe K J, "Finite Element Procedures in Engineering Analysis"- Prentice Hall
4. Rajasekaran. S, "Finite Element Analysis in Engineering Design"-Wheeler Publishing
5. Cook R D, Malkan D S & Plesta M.E, "Concepts and Application of Finite Element Analysis" - 3rd Edition, John Wiley and Sons Inc., 1989
6. Shames I H and Dym C J, "Energy and Finite Element Methods in Structural Mechanics"- McGraw Hill, New York, 1985

Web Link and Video Lectures:

1. https://nptel.ac.in/courses/105104160/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Earthquake Resistance Structures

Course Code	MVJ19CSE23	**CIE**	50
No. of Contact hours / Week	04	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**04**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principles of engineering seismology.
- To design the reinforced concrete buildings for earthquake resistance.
- To evaluate the seismic response of the structures

Modules	RBT Level	Hrs
Module-1		
Introduction: Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems.	**L1, L2**	**10 Hrs**
Module-2		
The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893.	**L2, L3, L4, L5**	**10 Hrs**
Module-3		
Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure	**L2, L4, L5**	**10 Hrs**

patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.		
Module-4		
Design of Reinforced concrete buildings for earthquake resistance- Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893. Structural behavior, design and ductile detailing of shear walls.	**L2, L4, L5**	**10 Hrs**
Module-5		
Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures.	**L2, L5, L6**	**10 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of engineering seismology
CO3: Design and develop analytical skills .
CO4: Understand the concepts of earthquake resistance of reinforced concrete buildings. .

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Dynamics of Structures – Theory and Application to Earthquake Engineering- 2nd ed. – Anil K. Chopra, Pearson Education.
2. Earthquake Resistant Design of Building Structures, Vinod Hosur, WILEY (india)
3. Earthquake Resistant Design of Structures, Duggal, Oxford University Press
4. Earthquake resistant design of structures - Pankaj Agarwal, Manish Shrikande - PHI India
5. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993
6. Design of Earthquake Resistant Buildings, Minoru Wakabayashi, McGraw Hill Pub.
7. Seismic Design of Reinforced Concrete and Masonry Buildings, T Paulay and M J N Priestley, John Wiley and Sons

Web Link and Video Lectures:

1. https://nptel.ac.in/courses/105101006/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Advanced Design of Pre-Stressed Concrete Structures

Course Code	MVJ19CSE241	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- Understand the concepts and techniques of precast construction and Select or design precast elements suitable for project specific requirements
- Design precast systems to ensure integrity and safety of the structure and to avoid progressive collapse and Design composite floors and beam elements

Modules	RBT Level	Hrs
Module-1		
Concepts , components, Structural Systems and Design of precast concrete floors Need and types of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections. **Design of precast Concrete Floors:**Theoretical and Design Examples of Hollow core slabs,. Precast Concrete Planks, floor with composite toppings with and without props.	**L1, L2, L4**	**8 Hrs**
Module-2		
Design of precast reinforced and prestressed Concrete beams Theoretical and Design Examples of ITB – Full section precast, Semi Precast, propped and unpropped conditions. Design of RC Nibs	**L1, L2, L5,**	**8 Hrs**
Module-3		
Design of precast concrete columns and walls Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints**.**	**L1, L2, L5**	**8 Hrs**
Module-4		
Design of Precast Connections and Structural Integrity Beam	**L1, L2, L4**	**8 Hrs**

bearing, Beam half Joint,Steel Inserts, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties.		
Module-5		
Design of Steel Concrete Composite Floors and Beams **Composite Floors**: Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example **Composite Beams:** Elastic Behaviour, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams.	**L1, L2, L3**	**8 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Design
CO3: Design and develop analytical skills.
CO4: Summarize the principles of prestressed rcc Design and detailing
CO5: Understands the structural performance.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

6) Hass A.M. – Precast Concrete – Design and applications Applied Science, 1983.
7) David Sheppard – "Plant cast, Precast and Prestressed concrete – McGraw Hill; 1989
8) NBC – 2005 (Part I to Part VII) BIS Publications, New Delhi, IS 159162011,IS 11447,IS6061 – I and III 4
9) R.P.Johnson: Composite Structure of Steel and Concrete (Volume 1), Blackwell Scientific Publication (Second Edition), U.K., 1994.
10) IS: 11384-1985, Code of Practice for Composite Construction in Structural Steel and Concrete.
11) INSDAG Teaching Resource Chapter 21 to 27: www.steel-insdag.org

Web Link and Video Lectures:

4) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Stability of Structures

Course Code	MVJ19CSE242	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principles of stability of structures.
- To analyse the structural elements for stability. To evaluate the use of strain energy in plate bending and stability.

Modules	RBT Level	Hrs
Module-1		
Beam – column – Differential equation. Beam column subjected to (i) lateral concentrated load, (ii) several concentrated loads, (iii) continuous lateral load. Application of trigonometric series, Euler's formulation using fourth order differential equation for pined – pined, fixed – fixed, fixed – free and fixed – pinned column.	**L1, L2**	**8 Hrs**
Module-2		
Buckling of frames and continuous beams. Elastic Energy method: Approximate calculation of critical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach. Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation. Bars with varying cross section. Effect of shear force on critical load. Column subjected to non – conservative follower and pulsating forces.	**L2, L3**	**8 Hrs**
Module-3		
Stability analysis by finite element approach – deviation of shape function for a two nodded Bernoulli – Euler beam element (lateral and translation of) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discretised column with different boundary condition – calculation of critical loads for a discretised (two elements)	**L2, L3, L4**	**8 Hrs**

column (both ends built in). Buckling of pin jointed frames (maximum of two active DOF) – symmetrical single bay portal frame.		
Module-4		
Lateral buckling of beams – differential equation – pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin – walled bars of open cross section. Non – uniform Torsion of thin – walled bars of open cross section.	**L1, L2, L3**	**8 Hrs**
Module-5		
Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate – uniaxial load and biaxial load. Buckling of uniformly compressed rectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides	**L1, L2, L3**	**8 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of strength and stability
CO3: Design and develop analytical skills.
CO4: Appraise the Stability analysis by finite element approach.
CO5: Understand the concepts of Lateral buckling of beams

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Stephen P.Timoshenko, James M Gere, "Theory of Elastic Stability"-2nd Edition, McGraw – Hill, New Delhi.
2. Robert D Cook et.al, "Concepts and Applications of Finite Element Analysis"-3rd Edition, John Wiley and Sons, New York.
3. S.Rajashekar, "Computations and Structural Mechanics"-Prentice – Hall, India.
4. Ray W Clough and J Penzien, "Dynamics of Structures" - 2nd Edition, McGraw Hill, New Delhi
5. H.Zeiglar, "Principles of Structural Stability"-Blaisdall Publications

Web Link and Video Lectures:

5) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Design of Precast & Composite Structures

Course Code	MVJ19CSE243	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principles of reliability, To implement the Probability Concepts for the Reliability Analysis.
- To evaluate different methods of reliability analysis.

Modules	RBT Level	Hrs
Module-1		
Concepts , components, Structural Systems and Design of precast concrete floors Need and types of precast construction, Modular coordination, Precast elements-Floor, Beams, Columns and walls. Structural Systems and connections. **Design of precast Concrete Floors:** Theoretical and Design Examples of Hollow core slabs. Precast Concrete Planks, floor with composite toppings with and without props	**L1, L4**	**8 Hrs**
Module-2		
Design of precast reinforced and prestressed Concrete beams Theoretical and Design Examples of ITB –Full section precast, Semi Precast, propped and unpropped conditions. Design of RC Nibs.	**L1, L4**	**8 Hrs**
Module-3		
Design of precast concrete columns and walls Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels. Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints.	**L1, L3**	**8 Hrs**
Module-4		
Design of Precast Connections and Structural Integrity Beam bearing, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties	**L1, L3**	**8 Hrs**

Module-5		
Design of Steel Concrete Composite Floors and Beams Composite Floors: Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example Composite Beams: Elastic Behavior, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams.	**L1, L4**	**8 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of prestressed elements.
CO3: Design and develop analytical skills.
CO4: Summarize the Probability distributions
CO5: Understand the concepts of prestressed elements.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Structural Precast Concrete Handbook, CIDB, Singapore
2. INSDAG Teaching Resource Chapter 21 to 24: www.steel-insdag.org
3. IS 15916 (2011): Building Design and Erection Using Prefabricated Concrete -Code of Practice [CED 51: Planning, Housing and pre-fabricated construction]
4. IS 1343-2012, IS 456-2000, IS 800-20075.
5. IS 11384 (1985):Code of Practice for Composite Construction in Structural Steel and Concrete [CED 38: Special Structures]

Web Link and Video Lectures:

6) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Reliability Analysis of Structures

Course Code	MVJ19CSE244	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principles of reliability, To implement the Probability Concepts for the Reliability Analysis.
- To evaluate different methods of reliability analysis.

Modules	RBT Level	Hrs
Module-1		
Preliminary Data Analysis: Graphical representation- Histogram, frequency polygon, Measures of central tendency- grouped and ungrouped data, measures of dispersion, measures of asymmetry. Curve fitting and Correlation: Fitting a straight line, curve of the form y = abx, and parabola, Coefficient of correlation.	**L1, L2**	**8 Hrs**
Module-2		
Probability Concepts: Random events-Sample space and events, Venn diagram and event space, Measures of probability-interpretation, probability axioms, addition rule, multiplication rule, conditional probability, probability tree diagram, statistical independence, total probability theorem and Baye's theorem	**L2, L3**	**8 Hrs**
Module-3		
Random variables: Probability mass function, probability density function, Mathematical expectation, Chebyshev's theorem. Probability distributions: Discrete distributions- Binomial and poison distributions, Continuous distributions- Normal, Log normal distributions.	**L2, L3, L4**	**8 Hrs**
Module-4		
Reliability Analysis: Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second	**L1, L2, L3**	**8 Hrs**

Moment Method (Hasofer-Lind's method)		
Module-5		
System reliability: Influence of correlation coefficient, redundant and non-redundant systemsseries, parallel and combined systems, Uncertainty in reliability assessments- Confidence limits, Bayesian revision of reliability. Simulation Techniques: Monte Carlo simulation- Statistical experiments, sample size and accuracy, Generation of random numbers- random numbers with standard uniform distribution, continuous random variables, discrete random variables	**L1, L2, L3**	**8 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of reliability
CO3: Design and develop analytical skills.
CO4: Summarize the Probability distributions
CO5: Understand the concepts of System reliability.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1Ranganathan, R. (1999). "Structural Reliability Analysis and design"- Jaico publishing house, Mumbai, India.

2. Ang, A. H. S., and Tang, W. H. (1984). "Probability concepts in engineering planning and design"- Volume –I, John Wiley and sons, Inc, New York.

3. Ang, A. H. S., and Tang, W. H. (1984). "Probability concepts in engineering planning and design"-Volume –II, John Wiley and sons, Inc, New York.

4. Milton, E. Harr (1987). "Reliability based design in civil engineering"- Mc Graw Hill book Co.

5. Nathabdndu, T., Kottegoda, and Renzo Rosso (1998). Statistics, "Probability and reliability for Civil and Environmental Engineers"- Mc Graw Hill international edition, Singapore.

6. Achintya Haldar and Sankaran Mahadevan (2000). "Probability, Reliability and Statistical methods in Engineering design"- John Wiley and Sons. Inc.

7. Thoft-christensen, P., and Baker, M., J., (1982), "Structural reliability theory and its applications"- Springer-Verlag, Berlin, NewYork.

8. Thoft-christensen, P., and Murotsu, Y. (1986). "Application of structural systems reliability theory"- Springer-Verlag, Berlin, NewYork

Web Link and Video Lectures:

7) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Advanced Structural Analysis

Course Code	MVJ19CSE251	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- Students will be given provided with the knowledge of mathematics, science, and engineering in the in the analysis of following structural systems curved beams, Beams on elastic foundation, shear centre and unsymmetrical bending and buckling of non-prismatic columns and beam column.

Modules	RBT Level	Hrs
Module-1		
Curved Beams Curved beams, Introduction, assumptions, derivation of WINKLER BACH equation, Radius to the neutral surface of simple geometric figures, Limitation, Stress distribution in open curved members such as Hooks and chain links, Stress distribution in closed rings and chain links. Deformations of open and closed rings.	**L1, L2, L3**	**8 Hrs**
Module-2		
Beams on Elastic Foundations Governing differential equation for elastic line, Interpretation of constants, Infinite beam with point load, moment & UDL with problems. Semi-infinite beams with point load and moment UDL with problems over fixed and hinged support conditions.	**L3,L4**	**8 Hrs**
Module-3		
Shear Centre Concept of shear center in torsion induced bending of beams, expression to the Shear Centre for Symmetrical and Unsymmetrical Sections, Derivation of shear centre for angles, channel, semicircular and built-up sections with numerical problems	**L3,L4**	**8 Hrs**
Module-4		
Unsymmetrical Bending (Asymmetrical Bending) Theory behind unsymmetrical bending, Assumptions, obtaining the stresses in beams, simply supported and cantilever unsymmetrical	**L3, L4**	**8 Hrs**

beams subjected to inclined loading, Deflections of unsymmetrical simply supported and cantilever beams with numerical problems.		
Module-5		
Buckling of Non Prismatic Columns and Beam-Column Principle behind Euler's theory of buckling, Governing differential equation applied to buckling of columns and evaluation of constants for various boundary conditions, Obtaining the characteristic equation for the buckling load of non-prismatic compound columns, Analysis of Beam-column, conceptual theory of magnification stresses and deformations subjected to axial and different types of lateral loads with numerical problems.	**L3, L4**	**8 Hrs**

Course outcomes:

CO1: Apply Winkler Bach and Strain Energy principles to obtain stresses and deformation in curved members.

CO2: Derive the expressions to Foundation pressure, Deflection, Slope, BM and SF of infinite and semi-infinite Beams resting on Elastic Foundation .

CO3: Obtain the equations for the shear centre for symmetrical and unsymmetrical from fundamental.

CO4: Extrapolate the bending theory to calculate the stresses and deformations in unsymmetrical bending.

CO5: Develop the characteristic equation for the buckling load of compound column and stresses and deformations in beam-column.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Vazirani V N and Ratwani M M "Advanced theory of structures and Matrix Method". 5th Edition,
2. HetenyiM."Beams on elastic foundation" 3rd printing, University of Michigan, USA, 1952.
3. Alexander Chatjes "Principles of Structural stability theory", Prentice – Hall of India, New Delhi, 1974.
4. Sterling Kinney "Indeterminate Structural Analysis", Oxford & IBH publishers

Web Link and Video Lectures:

8) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Design of High Rise Structures

Course Code	MVJ19CSE252	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- The objective of this course is to make students to learn principles of stability of tall buildings.
- To design the tall buildings for earthquake and wind resistance. To evaluate the performance of tall structures for strength and stability.

Modules	RBT Level	Hrs
Module-1		
Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads	**L1, L2**	**8 Hrs**
Module-2		
Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.	**L1, L3, L4, L5**	**8 Hrs**
Module-3		
Behavior of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Futigger – braced and hybrid mega system.	**L2, L3**	**8 Hrs**
Module-4		
Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses.	**L2, L3, L4**	**8 Hrs**

Module-5		
Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire	**L2, L3, L4, L5**	**8 Hrs**

Course outcomes:

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of strength and stability.
CO3: Design and develop analytical skills.
CO4: Summarize the behavior of various structural systems
CO5: Understand the concepts of P-Delta analysis.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

5. Taranath B.S, "Structural Analysis and Design of Tall Buildings"- McGraw Hill
6. Wilf gang Schuller, "High rise building structures"- John Wiley
7. Bryan Stafford Smith & Alexcoull, "Tall building structures Analysis and Design"- John Wiley
8. T.Y Lin & D.Stotes Burry, "Structural concepts and system for Architects and Engineers"- John Wiley
9. Lynn S.Beedle, "Advances in Tall Buildings"- CBS Publishers and Distributors.
10. Dr. Y.P. Gupta – Editor, "Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities"- New Age International Limited

Web Link and Video Lectures:

9) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Design of Industrial Structures

Course Code	MVJ19CSE253	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

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

Modules	RBT Level	Hrs
Module-1		
Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames	**L1, L2**	**8 Hrs**
Module-2		
Analysis and design of gantry column (stepped column / column with bracket), purlins, girts, bracings including all connections	**L1, L3, L4, L5**	**8 Hrs**
Module-3		
Analysis of transmission line towers for wind load and design of towers including all connections.	**L2, L3**	**8 Hrs**
Module-4		
Forms of light gauge sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light gauge sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength.	**L2, L3, L4**	**8 Hrs**
Module-5		
Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light gauge sections, Design of flexural members (Laterally restrained / laterally unrestrained).	**L2, L3, L4, L5**	**8 Hrs**
Course outcomes: **CO1:** Achieve Knowledge of design and development of problem solving skills. **CO2:** Understand the industrial building and the components.. **CO3:** Design and develop analytical skills.		

CO4: Summarize the principles of Structural Design and detailing
CO5: Understand the concepts of Pre- engineered buildings.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

11. Bureau of Indian Standards, IS800-2007, IS875-1987, IS-801-1975.Steel Tables, SP 6 (1) – 1984
12. N Subramanian- "Design of Steel Structure" oxford University Press
13. B.C. Punmia, A.K. Jain "Design of Steel Structures", Laxmi Publications, New Delhi.
14. Ramchandra and Virendra Gehlot " Design of Steel Structures " Vol 1 and Vol.2, Scientific Publishers, Jodhpur
15. Duggal "Limit State Design of Steel Structures" TMH

Web Link and Video Lectures:

10) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Structural Health Monitoring

Course Code	MVJ19CSE254	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- Structural Health Monitoring examines the use of low-cost, long term monitoring systems to keep civil infrastructure under constant surveillance, ensuring structural integrity. Moreover, the tools and skills the students will learn in this course can be implemented to develop sustainable maintenance and rehabilitation schemes and programs.

Modules	RBT Level	Hrs
Module-1		
Introduction to Structural Health Monitoring (SHM): Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design.	**L1, L2**	**8 Hrs**
Module-2		
Application of SHM in Civil Engineering: Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings.	**L2,L3,L4**	**8 Hrs**
Module-3		
Non Destructive Testing of Concrete Structures: Introduction to NDT- Situations and contexts, where NDT is needed, classification of NDT procedures, visual Inspection, half-Cell electrical potential methods, Schmidt Rebound Hammer Test, resistivity measurement, electromagnetic methods, radiographic Testing, ultrasonic testing, Infra-Red thermography, ground penetrating radar, radio isotope gauges, other methods.	**L3, L4**	**8 Hrs**
Module-4		

Condition Survey & NDE of Concrete Structure: Definition and objective of Condition survey, stages of condition survey (Preliminary, Planning, Inspection and Testing stages), possible defects in concrete structures, quality control of concrete structures - Definition and need, Quality control applications in concrete structures, NDT as an option	**L3, L4**	**8 Hrs**
Module-5		
Rehabilitation and Retrofitting of Concrete Structure: Repair rehabilitation & retrofitting of structures, damage assessment of concrete structures, Materials and methods for repairs and rehabilitation, modeling of repaired composite structure, structural analysis and design -Importance of re-analysis, execution of rehabilitation strategy, Case studies.	**L3, L4, L5**	**8 Hrs**

Course outcomes:

CO1: Diagnosis the distress in the structure understanding the causes and factors.
CO2: Assess the health of structure using static field methods.
CO3: Assess the health of structure using dynamic field tests.
CO4: Suggest repairs and rehabilitation measures of the structure

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Guide Book on Non-destructive Testing of Concrete Structures", Training course series No. 17, International AtomicEnergy Agency, Vienna, 2002.2.
2. "Hand Book on Seismic Retrofitting of Buildings", Published byCPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008.
3. Daniel Balageas, Claus - Peter FritzenamI Alfredo Guemes, "Structural Health Monitoring", Published by ISTE Ltd., U.K. 2006.
4. Douglas E Adams "Health Monitoring of Structural Materials and Components-Methods with Applications", John Wiley and Sons, 2007.
5. Hand book on "Repair and Rehabilitation of RCC Building", Published by Director General, CPWD, Govt. of India, 2002.
6. J. P. Ou, H. Li and Z. D. Duan, "Structural Health Monitoring and Intelligent Infrastructure", Vol1, Taylor and Francis Group, London, UK, 2006.
7. Victor Giurglutiu, Academic "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc, 2007.

Web Link and Video Lectures:

11) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Sustainability Concepts in Engineering

Course Code	MVJ19CSE261	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- Learn about the principles, indicators and general concept of sustainability.
- Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
- Student shall be able to apply the sustainability concepts in engineering
- Know built environment frameworks and their use
- Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

Modules	RBT Level	Hrs
Module-1		
Introduction: Sustainability -Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act	**L1,L2,L3**	**8 Hrs**
Module-2		
Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration –Carbon capture and sto rage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking	**L1,L2,L3**	**8 Hrs**
Module-3		
Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material	**L1,L2,L3,L4**	**8 Hrs**

selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities.		
Module-4		
Clean Technology and Energy: Energy sources: Basic concepts- Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting	**L1,L2,L3**	**8 Hrs**
Module-5		
Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.	**L1,L2,L3**	**8 Hrs**

Course outcomes:

CO1: Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.

CO2: Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.

CO3: Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.

CO4: Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice
6. Daniel A. Vallero and Chris Brasier, " Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers

Web Link and Video Lectures:

12) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Remote Sensing and GIS

Course Code	MVJ19CSE262	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- Understand the basic concepts of remote sensing.
- Analyze satellite imagery and extract the required units.
- Extract the GIS data and prepare the thematic maps
- Use the thematic maps for various applications.

Modules	RBT Level	Hrs
Module-1		
Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation),Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.	**L1,L2,L3**	**8 Hrs**
Module-2		
Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms-IRS, Landsat, SPOT, Cartosat, HoursIkonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering	**L2,L3,L4**	**8 Hrs**
Module-3		

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones	**L2,L3,L4**	**8 Hrs**
Module-4		
Data Models: Vector data model: Representation of simple features –Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.	**L3,L4,L5**	**8 Hrs**
Module-5		
Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications.	**L3,L4,L5,L6**	**8 Hrs**

Course outcomes:

CO1: Collect data and delineate various elements from the satellite imagery using their spectral signature.

CO2: Analyze different features of ground information to create raster or vector data. **CO3:** Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.

CO3: Perform digital classification and create different thematic maps for solving specific problems

CO4: Make decision based on the GIS analysis on thematic maps.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Chor Pang Lo and Albert K.W Yeung, "Concepts & Tech niques of GIS", PHI, 2006 2.
2. John R. Jensen, "Remote sensing of the environment" , An earth resources perspective – 2nd edition – by Pearson Education 2007.
3. Anji Reddy M., "Remote sensing and Geograperhical i nformation system", B.S. Publications 2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Informa tion system", Oxford Publications 2004.
5. S Kumar, "Basics of remote sensing & GIS", Laxmi pu blications 2005.

Web Link and Video Lectures:

13) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

Occupational Health and Safety

Course Code	MVJ19CSE263	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	50	**Total**	100
Credits	**03**	**Exam. Duration**	3 Hrs

Course Objectives

- Gain an historical, economic, and organizational perspective of occupational safety and health.
- Investigate current occupational safety and health problems and solutions. Extract the GIS data and prepare the thematic maps
- Identify the forces that influence occupational safety and health.
- Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Modules	RBT Level	Hrs
Module-1		
Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act(OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation	**L1,L2,L3**	**8 Hrs**
Module-2		
Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis –Fault Tree Analysis – Emergency Response - Decision for action – purpose and Considerations.	**L2,L3,L4,L5**	**8 Hrs**
Module-3		
Fire Prevention and Protection: Fire Triangle, Fire Development and itsseverity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety	**L2,L3,L4,L5**	**8 Hrs**

Module-4		
Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability	**L2,L3,L4,L5**	**8 Hrs**
Module-5		
Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors	**L3,L4,L5.L6**	**8 Hrs**

Course outcomes:

CO1: Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
CO2: Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
CO3: Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
CO4: Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
CO5: Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
2. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.
3. Goetsch D.L., (1999), "Occupational Safety and Heal th for Technologists, Engineers and Managers", Prentice Hall
4. Heinrich H.W., (2007), "Industrial Accident Prevention - A Scientific Approach", McGraw-Hill Book Company
5. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Pollution Control Handbook.

Web Link and Video Lectures:

14) http://qcin.org/CAS/RMCPC/

II Semester, M.Tech, Structural Engineering
[As Per Choice Based Credit System (CBCS)]
Effective from the Academic Year 2019 -2020

STRUCTURAL SOFTWARE LAB-2

Course Code	MVJ19CSEL27	**CIE**	50
No. of Contact hours / Week	03	**SEE**	50
Total No. of Contact	42	**Total**	100
Credits	02	**Exam. Duration**	3 Hrs

Course Objectives

- To learn the application of ETABS in Dynamic Analysis .
- To learn the application of ANSYS in Structural analysis problems
- To learn the application of FEM

Modules	RBT Level	Hrs
5. Seismic analysis of multi-storied buildings using ETABS. 6. Introduction to Ansys in various analysis problems.	**L1, L2, L4, L5, L6**	**3 Hrs**

Course outcomes:
CO1: Understand the general considerations of analysis
CO2: Achieve Knowledge application of ETABS.
CO3: Understand the principles FEM
CO4: Achieve Knowledge application of ANSYS.

Question paper pattern:

- The question paper will have two questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions from each part.
- The students will have to answer 2 full questions, and record consists of 10 marks.

Web Link and Video Lectures:

3. https://www.youtube.com/watch?v=k2rAFEUNrTc
4. https://www.youtube.com/watch?v=1e-virnY7Ts