Course Title	**ADVANCED DESIGN OF RCC STRUCTURES**	Semester	I
Course Code	MVJ19CSE11	**CIE**	50
Total No. of Contact Hours	60 L : T : P :: 40 : 0 :20	**SEE**	50
No. of Contact Hours/Week	4	**Total**	100
Credits	4	**Exam Duration**	3Hrs

Course objective is to: This course will enable the students to

- Make students to learn principle of structural design
- Design different types of structures
- Detail the structures.
- Evaluate the performance of structures
- Develop analytical skills in solving structural problems.

Module-1	**L3,L4 & L5**	**12Hrs.**

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.

Laboratory Sessions/ Experimental learning:

- Cast a beam (either PCC or RC) and identify crack width

Applications:

- Design of multi-storey structures like apartments (10-20 storeys)

Video link / Additional online information:

- https://nptel.ac.in/courses/105/106/105106117/

Module-2	**L3,L4 & L5**	**12Hrs.**

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.

Laboratory Sessions/ Experimental learning:

- Compare the results of RC slab using normal and yield-line analysis and explain them

Applications:

- Design of multi-storey structures.

Video link / Additional online information:

- https://www.studocu.com/row/document/national-university-of-science-and-technology/structure-analysis/lecture-notes/chapter-1-9-yield-line-analysis-of-slabs/5916250/view

Module-3	L3,L4 & L5	12Hrs.

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.

Laboratory Sessions/ Experimental learning:

- Model making on flat slabs, Testing Flat slabs based on design and analysing failure criteria due to load

Applications:

- Design of multi-storey structures

Module-4	L3,L4 & L5	12Hrs.

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.

Laboratory Sessions/ Experimental learning:

- Model making of Deep beams and corbels

Applications:

- Design of multistory and industrial structures

Module-5	L3,L4,L5	12Hrs.

Design of Elevated Intz type of Water Tank, Design of silos and bunkers.

Laboratory Sessions/ Experimental learning:

- Model making on water tank, Silos and Bunkers

Applications:

- Design of industrial structures

Video link / Additional online information:

- https://nptel.ac.in/courses/105/105/105105105/

Course outcomes: On completion of the course, students would be able to	
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.

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

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	1	-	3	3	3	1	-	1
CO2	1	3	2	3	2	-	3	3	-	1	-	3
CO3	3	2	-	3	-	3	3	2	1	1	2	1
CO4	2	2	-	1	1	3	-	-	2	-	2	2
CO5	3	1	3	2	3	3	2	1	1	2	3	1

High-3, Medium-2, Low-1

Course Title	**MECHANICS OF DEFORMABLE BODIES**	Semester	I
Course Code	MVJ19CSE12	**CIE**	50
Total No. of Contact Hours	60 L : T : P :: 40 : 0 : 20	**SEE**	50
No. of Contact Hours/Week	4	**Total**	100
Credits	4	**Exam Duration**	3Hrs

Course objective is to: This course will enable the students to

- Make students to learn principles of Analysis of Stress and Strain
- Predict the stress-strain behaviour of continuum
- Evaluate the stress and strain parameters and their inter relations of the continuum
- Develop the Propagation of waves in solid media
- Apply the nonlinear stress strain relationship of concrete for design

Module-1	**L3**	**12Hrs**

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.

Laboratory Sessions/ Experimental learning:

- Formulating code of program for compatibility equation

Applications:

- Microscopic defects in solids
- Load Carrying ability of Engineering Structures

Video link / Additional online information:

- Elasticity: https://nptel.ac.in/courses/105105177/

Module-2	**L3**	**12Hrs**

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 maximum shear strain.

Laboratory Sessions/ Experimental learning:

- Formulating code of program for Principal stresses, Strains, hydrostatic and deivatric stress

Applications:

- Continuum Mechanics
- Yield criteria for ductile materials

Video link / Additional online information:

- Transformation of stress : https://nptel.ac.in/courses/112102284/

Module-3	**L3**	**12Hrs**

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 in plates.

Laboratory Sessions/ Experimental learning:

- Model Making of Simple Bending of beam with instant result

Applications:

- Plate with riveted joint
- Gas Pipeline

Video link / Additional online information:

- Plane stress and Strain : https://nptel.ac.in/courses/112101095/

Module-4	**L3,L4**	**12Hrs**

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.

Laboratory Sessions/ Experimental learning:

- Development of Propagation of waves in solid media under given stress condition

Applications:

- Plate Analysis (Twist and Stretching)
- Torsional effect in Circular Pipe

Video link / Additional online information:

- Prismatic Bar: https://nptel.ac.in/courses/105106049/

Module-5	L3	12Hrs

Theory of Plasticity: One-dimensional elastic-plastic relations, isotropic and kinematic hardening, yield function, flow rule, hardening rule, incremental stress-strain relationship, governing equations of elasto-plasticity, 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-strain relationship. Implementation of plasticity in metals and concrete – principles only – metals - plastic stress strain matrix for metals- nonlinear stress strain relation in concrete.

Laboratory Sessions/ Experimental learning:

- Check the stress condition in simple plastic problems
- Model making of stress development in thick walled cylinder

Applications:

- Metal Forming
- Failure Plane Prediction in Earthquake and its vibration

Video link / Additional online information:

- Theory of plasticity: https://nptel.ac.in/courses/112/103/112103279/

Course outcomes: On completion of the course, students would be able to

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

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

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	1	-	2	1	3	1	-	1
CO2	2	2	2	3	2	-	2	2	-	1	-	3
CO3	3	2	1	3	3	3	3	1	1	1	-	-
CO4	3	2	-	1	3	3	-	-	2	-	-	-
CO5	1	1	3	2	3	2	2	1	1	2	-	

High-3, Medium-2, Low-1

Course Title	**STRUCTURAL DYNAMICS**	Semester	I
Course Code	MVJ19CSE13	**CIE**	50
Total No. of Contact Hours	60 L : T : P :: 40 : 0 : 20	**SEE**	50
No. of Contact Hours/Week	4	**Total**	100
Credits	4	**Exam Duration**	3Hrs

Course objective is to: This course will enable the students to

- Learn principles of Structural Dynamics
- Implement these principles through different methods and to apply the same for free and forced vibration of structures
- Evaluate the dynamic characteristics of the structures

Module-1	**L3,L5**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of structural analysis and Engineering Mathematics*

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.

Laboratory Sessions/ Experimental learning:

- Experiments on determining the different vibration of Structure.

Applications:

- Understanding the different vibration acting on Structures.
- Vibration mitigating materials like damping can be developed with thorough knowledge.

Video link / Additional online information:

- https://www.youtube.com/watch?v=pixaQGkM1-M/
- https://nptel.ac.in/courses/112105055

Module-2	**L3, L4, L5**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of structural analysis and Engineering Mathematics*

Response of Single-degree-of-freedom systems to harmonic loading including support motion, vibration isolation, transmissibility.

Principle of vibration measuring instruments–seismometer and accelerometer.

Laboratory Sessions/ Experimental learning:

- Determining the complete response of an SDOF due to different Damping Condition.

Applications:

- The use of seismometer and accelerometer give the intensity of Vibration on a Structure.
- The effect of damping can be understood using damped and un-damped SDOF.

Video link / Additional online information:

- https://nptel.ac.in/courses/105101006/
- https://www.youtube.com/watch?v=RKfZ081epsM

Module-3	**L3, L4, L5**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of structural analysis and Engineering Mathematics*

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.

Laboratory Sessions/ Experimental learning:

- Determining the Different Mode shapes in MDOF System using FEM software due to free and forced Vibration.
- Determining the Different Natural frequency in MDOF System using FEM software due to free and forced Vibration.

Applications:

- The Different mode shapes and frequency can be determined due to free and forced Vibration.
- Vibration on structures can be reduced using different damping condition.

Video link / Additional online information:

- https://nptel.ac.in/courses/105101006/
- https://nptel.ac.in/courses/105106151/

Module-4	**L3, L4, L5**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of structural analysis and Engineering Mathematics*

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.

Laboratory Sessions/ Experimental learning:

- Determining the Displacement in MDOF System using FEM software due to free and forced

Vibration.

- Determining the Displacement in MDOF System using FEM software due to free and forced Vibration

Applications:

- The Different Displacement can be determined due to free and forced Vibration.
- The displacement due to Earthquake loads

Video link / Additional online information:

- https://nptel.ac.in/courses/105105166/
- https://nptel.ac.in/courses/105102016/

Module-5	**L3, L4**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of structural analysis and Engineering Mathematics*

Approximate methods: Rayleigh's method, Stodola and Dunkerley's method. Dynamics of Continuous systems: Flexural vibration of beams with different end conditions. Stiffness matrix, mass matrix (lumped and consistent).

Laboratory Sessions/ Experimental learning:

- Determining the different Mode shapes and frequency in MDOF System using FEM software and comparing the result with Rayleigh's method wrt to bridges under moving load.
- Determining the different Mode shapes and frequency in MDOF System using FEM software and comparing the result with Stodola's method wrt to bridges under moving load.
- Determining the different Mode shapes and frequency in MDOF System using FEM software and comparing the result with Dunkarley's method wrt to bridges under moving load..

Applications:

- The Different mode shapes and frequency can be determined due to free and forced Vibration by approximate methods.

Video link / Additional online information:

- https://swayam.gov.in/nd1_noc20_ce21/preview

Course outcomes: On completion of the course, students would be able to

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

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

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	-	3	3	3	1	-	1
CO2	2	3	2	3	2	-	3	3	-	1	3	3
CO3	2	2	-	3	-	3	3	2	1	3	1	1
CO4	2	2	-	1	1	3	3	2	1	-	3	2
CO5	3	1	2	3	3	3	2	1	-	-	-	1

High-3, Medium-2, Low-1

Course Title	**SPECIAL CONCRETE**	**Semester**	I
Course Code	MVJ19CSE14	**CIE**	50
Total No. of Contact Hours	60 L: T: P: 40: 0: 20	**SEE**	50
No. of Contact Hours/Week	4	**Total**	100
Credits	4	**Exam Duration**	3Hrs

Course objective is to:

- Provide a comprehensive study of the constituent materials of concrete.
- Learn the principles of concrete mix design, and assess the performance of special cement composite.
- Learn the characteristics and performance of various types of cement-based concrete.
- Learn to characterize and predict the behaviour of special concrete.
- Give an insight to repair principles and quality control measures.

Module-1	**L3 & L5**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of concrete technology and material science.*

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.

Laboratory Sessions/Experimental learning:

- Experimental investigation on effect of different mineral and chemical admixtures on the properties of concrete.
- Comparative study of IS, ACI and BS methods of mix proportioning.
- Testing of special cements as per the code procedures.

Applications:

- Evaluating the effectiveness of admixtures on the rheological properties of concrete.
- Provides insight of various techniques of mix proportioning using the standards.

- Gain knowledge on the performance of blended cements.

Video link / Additional online information:

- http://www.theconcreteportal.com- Rheology, effect of mineral and chemical admixtures on properties of concrete and mix design.
- https://nptel.ac.in/courses/105106176- Role of constituents of concrete, Rheology, effect of mineral and chemical admixtures on properties of concrete and mix design.
- https://www.understanding-cement.com
- https://ciks.cbt.nist.gov/garbocz/

Module-2	**L3 & L5**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of concrete technology and material science.*

Ferro cement: Materials, mechanical properties, types and methods of construction, Design of ferrocement in tension 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): Properties, microstructure, robustness, applications- adoption of SCC in the precast industry.

Laboratory Sessions/Experimental learning:

- Experimental investigation on the properties of ferrocement and SCC.
- Experimental study on strength characteristics of high-density concrete.

Applications:

- Understanding the concepts and characteristic performance of ferro cement, high density and SC concrete.

Video link / Additional online information:

- http://www.theconcreteportal.com- Self-compacting Concrete.
- https://nptel.ac.in/courses/105/102/105102012/- Self-compacting Concrete.
- https://www.understanding-cement.com

Module-3	**L3 & L4**	**12Hrs**

Prerequisites*: Knowledge in the fundamentals of concrete technology and material science.*

Other concretes of 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: Shotcreting, Pre-placed aggregate, anti-washout concretes, concrete pumping, tremie placement for underwater applications.

Laboratory Sessions/Experimental learning:

- Experimental investigation on recent constituent materials used in concrete and evaluate their performance.

Applications:

- Gain knowledge on the feasibility of special properties concrete.
- Provides knowledge on various concreting operations.

Video link / Additional online information:

- http://www.theconcreteportal.com- Concrete pumping, reactive powder concrete.
- https://nptel.ac.in/courses/105/102/105102012/- High-volume fly ash concretes, geo-polymer concrete
- https://www.understanding-cement.com- Shotcreting, aerated concrete.
- https://ciks.cbt.nist.gov/garbocz/- Pervious concrete, Heat resistant and refractory concrete.

Module-4	**L3 & L4**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of concrete technology and material science.*

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, properties in fresh and hardened state, applications.

Mass concrete and Roller compacted concrete: Constituents, mix proportioning, properties in fresh and hardened states, applications and limitations.

Laboratory Sessions/Experimental learning:

- Experimental investigation on suitability and determining the strength parameters of special concretes.

Applications:

- Gain knowledge on the role of mix proportions and procedure to determine the fresh and hardened state of special concrete.

Video link / Additional online information:

- http://www.theconcreteportal.com- Changes in concrete with respect to time.

- https://nptel.ac.in/courses/105/102/105102012/- Mass concrete and roller compacted concrete, high strength concrete.
- https://www.understanding-cement.com

Module-5	**L3**	**12Hrs**

Prerequisites: *Knowledge in the fundamentals of concrete technology and material science.*

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.

Laboratory Sessions/Experimental learning:

- Evaluation of corrosion protection methods by experimental investigations/studies.
- Visit to construction site to understand construction quality management.

Applications:

- Gain knowledge on materials and methods of corrosion control.
- Practical outlook on quality control and assurance as per the standards.
- Understand the concept of recycling and reuse of materials in concrete with sustainable approach.

Video link / Additional online information:

- http://www.theconcreteportal.com- Quality control and assurance.
- https://nptel.ac.in/courses/105/102/105102012/- Sustainable concrete.
- https://www.understanding-cement.com

Course outcomes: On completion of the course, students would be able to

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	Evaluate the effect of the environment on service life performance, properties and failure of structural concrete.
CO4	Understand the concepts, mix proportioning of special concreting operations.
CO5	Understand the concepts of repair, sustainability and quality control.

Reference Books:	
1.	Santhakumar A R, "Concrete Technology"- Oxford University Press, New Delhi, 2nd Edition, April 2018.
2.	Gambhir M L, "Concrete Technology: Theory and Practice", Tata McGraw Hill, Publishing Co. Ltd New Delhi, 5th edition, 2014.
3.	Krishnaraju N- "Design of concrete mixes" CBS Publishers and Distributors Pvt Ltd., Delhi, 5th edition, 2018.
4.	Mehta P K & P J M Monteiro, "Concrete: Microstructure, Properties and Materials", McGraw-Hill Education, 4th edition, 2013.
5.	Aitcin P C, "High Performance Concrete"- Boca Raton: CRC Press, 2019.
6.	Rafat Siddique "Special Structural Concretes", Galgotia publications, New Delhi, 2000.
7.	Neville. A. M "Properties of Concrete", Prentice Hall, 5th edition, 2012.
8.	M S Shetty and A K Jain, "Concrete Technology", S. Chand publishing House Ltd., New Delhi, Eighth edition, 2018.
9.	Rixom R and Mailvaganam N, "Chemical admixtures in concrete"- E and FN Spon, London, 3rd Edition, 1999.
10.	Newman J & Choo B S, "Advanced concrete technology 3: processes", Butterworth-Heinemann, 1st edition, 2003.
11.	ACI 211, Code for Mix Design.
12.	IS 10262-2009, Concrete Mix Proportioning – Guidelines, BIS, New Delhi.
13.	BS 8110: Part 1- Structural use of concrete - Code of practice for design and construction.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	1	1	1	-	1	-	2
CO2	3	1	-	1	-	-	2	-	-	1	-	1
CO3	3	3	2	2	-	1	2	1	-	1	-	2
CO4	3	1	2	1	2	1	1	1	2	1	-	2
CO5	3	3	3	2	1	2	3	1	2	1	1	2

High-3, Medium-2, Low-1

Course Title	**RESEARCH METHODOLOGY AND IPR**	Semester	I
Course Code	MVJ19IPR15	**CIE**	50
Total No. of Contact Hours	60 L : T : P :: 40 : 0 : 20	**SEE**	50
No. of Contact Hours/Week	2	**Total**	100
Credits	2	**Exam Duration**	3Hrs

Course objective is to: This course will enable the students to

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

Module-1	**L3**	**12Hrs**

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, **Research Ethics** and Problems Encountered by Researchers in India.

Laboratory Sessions/Experimental learning:

- Formulating Case study report on Problems Encountered by the Scholar's involved in research

Applications:

- Research Design
- Layout Plan for Alternatives

Module-2	L3	12Hrs

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An 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.

Laboratory Sessions/Experimental learning:

- Developing Conceptual Framework for Literature review under given issues

Applications:

- Review Paper Preparation
- Article Preparation for Research

Video link / Additional online information:

- Review of Literatures: https://nptel.ac.in/courses/110/105/110105091/

Module-3	L3	12Hrs

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.

Laboratory Sessions/Experimental learning:

- Preparation of particular layout for different types of sampling design

Applications:

- Strategy Planning for Resource Management
- Alternatives Risk Management

Video link / Additional online information:

- Qualitative Research : https://nptel.ac.in/courses/109105115/

Module-4	L3	12Hrs

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method

– Advanced Computing Techniques, Development of Software

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout, **Records and Lab report**

Laboratory Sessions/Experimental learning:

- Formulating Layout of Research Report for the given research work

Applications:

- Thesis Writing
- Journal Writing

Video link / Additional online information:

- Report Writing: https://nptel.ac.in/courses/121106007/

Module-5	**L3**	**12Hrs**

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 Intellectual Property Organisation (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.

Laboratory Sessions/Experimental learning:

- Formulating Patent Draft for Provision Specifications with detailed diagrams

Applications:

- Provisional and Detailed Specification for filing the patent
- Design patenting

Video link / Additional online information:

- Intellectual Property Rights: https://nptel.ac.in/courses/110105139/

Course outcomes: On completion of the course, students would be able to

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.

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.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	3	-	-	1	2	3	1	-	1
CO2	3	2	2	3	2	-	3	3	1	1	-	3
CO3	2	1	-	-	-	3	2	2	3	1	3	2
CO4	1	1	2	-	1	3	3	3	1	-	1	1
CO5	2	2	1	3	3	2	3	2	1	2	3	1

High-3, Medium-2, Low-1

Course Title	**ADVANCED CONCRETE LAB**	Semester	I
Course Code	MVJ19CSEL16	**CIE**	50
Total No. of Contact Hours	01 Hour Tutorial (Instruction) 03 Hours Laboratory	**SEE**	50
No. of Contact Hours/Week	4	**Total**	100
Credits	2	**Exam Duration**	3Hrs

Course objective is to: This course will enable the students to

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

SL.NO	**Experiments**	**L3**
1	Determination of Tensile and Compressive Strength of Concrete, including Mix design	
2	Conducting Test on beams for deflection, flexure and shear	
3	Conducting Non-destructive testing on materials using (NDT) equipment's –Rebound hammer, Ultra sonic pulse velocity meter and Profometer	

Video link / Additional online information:

- https://www.csiamerica.com/products/etabs
- https://www.youtube.com/watch?v=LOtuwW9-G68

Course outcomes: On completion of the course, students would be able to

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 equipment's.

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

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		3	1	1	1		2		1	1
CO2	1	1	1	2		2	1		2		1	1
CO3	1		2	1	1	2	1		2		1	1
CO4				1		2			2		1	1

High-3, Medium-2, Low-1

Course Title	**STRUCTURAL SOFTWARE LAB-1**	Semester	I
Course Code	MVJ19CSEL17	**CIE**	50
Total No. of Contact Hours	01 Hour Tutorial (Instruction) 03 Hours Laboratory	**SEE**	50
No. of Contact Hours/Week	4	**Total**	100
Credits	2	**Exam Duration**	3Hrs

Course objective is to: This course will enable the students to

- 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.

SL.NO	**Experiments**	**L4, L5, L6**
1	Static and Dynamic analysis and design of Multi-story 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	

Video link / Additional online information:

- https://www.nptel.ac.in/courses/121106007/
- https://nptel.ac.in/courses/107108011/

Course outcomes: On completion of the course, students would be able to

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 equipment's.

Reference Books:

1.	Mukhopadhaya M , "*structural dynamics Vibrations*" Oxford IBH, 2nd Edition 2014.
2.	Mario Paz "*Structural Dynamics*" CBS publishers,5th Edition 2004
3.	Timoshenko S, Van-Nostrand "*Vibration Problems in Engineering*" C, th Edition 2006

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		3	1	1	1		2		1	1
CO2	1	1	1	2		2	1		2		1	1
CO3	1		2	1	1	2	1		2		1	1
CO4				1		2			2		1	1

High-3, Medium-2, Low-1