CURRICULUM

For the Academic year 2026 – 2027

DEPARTMENT OF CIVIL ENGINEERING

I to IV Semester

M. Tech Structural Engineering

BATCH 2026

RAMAIAH INSTITUTE OF TECHNOLOGY

(Autonomous Institute, Affiliated to VTU)

BANGALORE – 54

About the Institute

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 18 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A+' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visveswaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 70% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation.

The Entrepreneurship Development Cell (EDC) and "Ramaiah Evolute" have been set up on campus to incubate startups. MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 75th rank among 1584 top Engineering Institutions & 31st Rank among 131 Schools of Architecture in India for the year 2025.

About the Department:

The Department of Civil Engineering was started as the third department in theinstitute with an intake of 60 students in the year 1971. Structural Engineering was first Post Graduate program started in the year 1983 of the institute with an intake of 10 students. The UG and PG programs have been accredited by NBA for three years 2021-2024 and 2024-2027 respectively. After obtaining the autonomous status in the year 2007, the department focused towards providing state of the art curriculumdevelopment, offering electives of the present day need and techno innovative projects. These initiatives resulted in enhanced performance of the students in terms of increase in placement, increase in the number of students writing competitive examinations and pursuing higher education in the foreign universities.

Further Department of Civil Engineering was recognized as a research centre in the year 1994 leading to PhD/MSc in Civil Engineering under Bangalore University till 1994 and later it was brought under State Technological University VTU. The research centre has attracted 23 PhD research scholars to pursue their degree from this research centre and 29 scholars have completed PhD degree. The areas of research include Structural Engineering, Transportation Engineering, Geotechnical Engineering, Water Resources Engineering and Environmental Engineering.

The Department has close interaction with number of industries and Government agencies through R&D, and consultancy works. It also has MOU"s with industries and other institutes for improved interactions and coordination with outside world.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To become a premier Department by adopting state-of-the-art technical knowledge through effective learning processes with research ambience in producing global quality ethical civil engineers, for the development of sustainable society.

MISSION OF THE DEPARTMENT

1. To transform the young minds into employable professionals by providing contemporary technical knowledge and appropriate professional skills through suitable teaching learning process.
2. To provide rigorous training, acquaint the students with necessary skills and leadership qualities along with ethical values to address the complex and multi-faceted civil engineering problems.
3. To provide opportunity to develop their potential by fostering intellectual curiosity to promote them for pursuing higher studies and research through exposure to the modern engineering tools and techno innovative projects.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Mater of Technology (Structural Engineering) graduates of Civil Engineering program of M S Ramaiah Institute of Technology shall attain the following PEO's within three to four years of graduation.

The graduate will;

PEO1	Adopt for analysis and design of structural systems in consulting with Government agencies.
PEO2	Contribute for technical knowledge enhancement through teaching and research.
PEO3	Demonstrate professional practice, communication skills and lifelong learning.

PROGRAM OUTCOMES (POs):

PO1: An ability to independently carryout research/investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: An ability to adopt contemporary technology for the analysis and design of sustainable engineering systems.

PO5: An ability to simulate the model of the structure and predict its structural feasibility, culminating to a technical report for societal applications.

Curriculum Course Credits Distribution

Semester	Professional Core Courses (PCC)	Professional Core Courses Lab (PCCL)	Professional Elective Course (PEC)	Mandatory Credit Course (MCC)	Project Work/ Seminar (PW)	Internship (INT)	Total semester Credits
First	11	2	6	3	--	--	**22**
Second	12	2	9	--	--	--	**23**
Third	--	--	6	--	6	5	**17**
Fourth	--	--	--	--	18	--	**18**
Total	**23**	**4**	**21**	**3**	**24**	**5**	**80**

SCHEME OF TEACHING FOR STUDENTS ADMITTED FROM 2022
M Tech (STRUCTURAL ENGINEERING)

1st SEMESTER

Sl. No	Course Code	Subject	Category	Credits*				Total Contact Hours/week
				L	T	P	Total	
1	MST11	Applied Mathematics	Maths	2	1	0	3	4
2	MST12	Advanced Structural Analysis	PCC	3	1	0	4	4
3	MST13	Mechanics of Deformable Bodies	PCC	4	0	0	4	4
4	MSTE14x	Professional Elective Course-1	PEC	3	0	0	3	3
5	MSTE15x	Professional Elective Course-2	PEC	3	0	0	3	3
6	RMI16	Research Methodology & IPR	MCC	3	0	0	3	3
7	MSTL17	Advanced Concrete Laboratory	PCCL	0	0	1	1	2
8	MSTL18	Non Destructive Testing Laboratory	PCCL	0	0	1	1	2
Total							**22**	25

Where x=1,2,3…

L –Lecture, T – Tutorial, P- Practical

NOTE: * Common curriculum across all branches.

Professional Elective Courses			
Subject Code	**Subject**	**Subject Code**	**Subject**
MSTE141	Advanced Design of Concrete Structures	MSTE151	Computational Structural Mechanics
MSTE142	Experimental Stress Analysis	MSTE152	Optimization Methods in Structural Engg
MSTE143	Special Concrete	MSTE153	Design of Form Works

2nd SEMESTER

Sl. No	Course Code	Subject	Category	Credits*				Total Contact Hours/week
				L	T	P	Total	
1	MST21	Theory of Plates and Shells	PCC	3	1	0	4	5
2	MST22	Structural Dynamics	PCC	3	1	0	4	4
3	MST23	Finite Element Methods in Structural Analysis	PCC	4	0	0	4	4
4	MSTE24x	Professional Elective Course-3	PEC	3	0	0	3	3
5	MSTE25x	Professional Elective Course-4	PEC	3	0	0	3	3
6	MSTE26x	Professional Elective Course-5	PEC	3	0	0	3	3
7	MSTL27	Advanced Computation Laboratory	PCCL	0	0	1	1	2
8	MSTL28	Dynamics and Earth Quake Engg. Laboratory	PCCL	0	0	1	1	2
Total							**23**	**26**

Where x=1,2,3…

L –Lecture, T – Tutorial, P- Practical

Professional Elective Courses					
Subject Code	**Subject**	**Subject Code**	**Subject**	**Subject Code**	**Subject**
MSTE241	Rehabilitation and Retrofitting of Structures	MSTE251	Design of Concrete Bridges	MSTE261	Design of Tall Structures
MSTE242	Advanced Pre-Stressed Concrete	MSTE252	Stability Analysis of Structures	MSTE262	Masonry Structures
MSTE243	Fracture Mechanics	MSTE253	Steel-Concrete Composite Structures	MSTE263	Analysis and Design of Offshore Structures

3rd SEMESTER

Sl. No	Course Code	Subject	Category	Credits*				Total Contact Hours/week
				L	T	P	Total	
1	MSTE31x	Professional Elective Course*-6	PCC	3	0	0	3	3
2	MSTE32x	Professional Elective Course*-7	PEC	3	0	0	3	3
3	MSTI33	Internship/Industrial Training	INT	0	0	5	5	5
4	MSTP34	Project Work – I	PW	0	0	6	6	6
Total				**6**	**0**	**11**	**17**	**17**

Where x=1,2,3…

L –Lecture, T – Tutorial, P- Practical

Professional Elective Courses			
Subject Code	**Subject**	**Subject Code**	**Subject**
MSTE311	Advanced Design of Steel Structures	MSTE321	Design of Earthquake Resistant Structures
MSTE312	Pre-Fabricated Structures	MSTE322	AI Applications in Civil Engineering
MSTE313	Composite and Smart materials	MSTE323	Design of Substructures

NOTE: *Courses have to be completed using online NPTEL platform. If course content is not available on NPTEL then recorded lectures to be provided to students. Evaluation for CIE &SEE to be done by faculty in-charge.

4th SEMESTER

Sl No	Course Code	Subject	Category	Credits*				Total Contact Hours/week
				L	T	P	Total	
1	MSTP41	Project Work- II	PW	0	0	18	18	18
Total				0	0	18	18	18

(L= Lecture T=Tutorial P=Practical) Grand Total of Credits: 80

APPLIED MATHEMATICS

Course Code: MST11 **Credit: 2:1:0**
Course Coordinator: Dr. Suresh Babu **Contact Hours: 28+14**

Course Content

Unit I

Linear differential equations of second and higher Order: Formation, Solution of homogeneous and non-homogeneous linear differential equations. Importance of complementary function and Particular integral, Applications of LDE's to solve the structural dynamics problems. Illustration using online tools.

- Pedagogy / Course delivery tools
  - Chalk and talk, Power Point Presentation
-
  -
- Links:
  - https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/119640/593
  - https://a.impartus.com/ilc/#/course/59742/295

Unit II

Linear algebra-I: Review of Matrix algebra, elementary transformations on a matrix, Echelon form & rank of a matrix, Consistency of system of linear equations. Gauss elimination, Jacobi's & Gauss – Seidel methods to solve system of linear equations. Thomas algorithm for tridiagonal system, LU decomposition. Illustration using online tools.

- Pedagogy / Course delivery tools
  - Chalk and talk, Power Point Presentation, Videos
- Links:
  - https://nptel.ac.in/courses/111/108/111108066/
  - https://nptel.ac.in/courses/111/105/111105035/
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/619570/1030

Unit III

Linear algebra-II: Eigen values and eigenvectors of a matrix, Rayleigh-Power method to determine the dominant eigen value of a matrix, diagonalization of square matrices. Applications of eigenvalues and eigenvectors and diagonalization. Illustration using online tools.

- Pedagogy / Course delivery tools
  - Chalk and talk, Power Point Presentation, Videos
- Links:
  - https://nptel.ac.in/courses/111/108/111108066/
  - https://nptel.ac.in/courses/111/105/111105035/
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/619570/1030

Unit IV

Numerical Analysis and PDEs: Interpolation and Extrapolation, Lagrange's method, Applications of Lagrange's interpolation to derive one node, two node, three node and five node shape functions in 1-d and 2-d elements, Stiffness matrix for a bar element using one node. Solution of ODEs using Galerkin's method. Numerical Integration- Gaussian quadrature formula, Applications of numerical integration using Simpson's rules. Formation of PDEs, Solution of PDEs by direct method and Method of separation variables.

- Pedagogy / Course delivery tools
  - Chalk and talk, Power Point Presentation, Videos
- Links:
  - https://nptel.ac.in/courses/111/106/111106101/
  - https://archive.nptel.ac.in/courses/112/105/112105308/
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/96127/452
  - https://a.impartus.com/ilc/#/course/132243/636

Unit V

Calculus of variation: Variation of a functional, Extremal of a functional, Euler-Lagrange equation and its particular forms, Standard variational problems, Geodesics, Hanging cable and Brachistochrone problems. Isoperimetric problems.

- Pedagogy/Course delivery tools
  - Chalk and talk, PowerPoint Presentation
- Links:
  - https://nptel.ac.in/courses/111104025
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/621524/1030

Text Books:

1. **David C. Lay, Steven R. Lay and Judi J. Mc. Donald** – Linear Algebra and its Applications – Pearson – 5th edition – 2015.
2. **S.S. Sastry** – Introductory Methods of Numerical Analysis – Prentice Hall of India – 5th edition – 2012.
3. **B. S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.

Reference Books:

1. **Peter V. O'Neil –** Advanced engineering Mathematics **–** Thomson -5th edition-2003
2. **Anil K Chopra** –Dynamics of Structures –Pearson Publications-New Delhi-3rd edition-2007.
3. **I. M. Gelfand and S.V. Fomin-**Calculus of Variations-Dover publications-2000.

Course Outcomes (COs):

Students wil

l be able to

- Analyze the concept of various methods to solve the higher order LDE's to solve the free and forced vibration problems. (PO-1, 3, 5)
- Solve the system of linear algebraic equations by various direct and iterative methods appears in structural engineering. (PO-1, 3, 5)
- Solve the eigenvalue system and diagonilization of a square matrix. (PO-1, 3, 5)
- Analyze the problems of Lagrange's interpolation and its application to solve the structural dynamic problems. (PO-1, 3, 5)
- Apply the knowledge of different forms of Euler-Lagrange equation to solve the standard variational problems in engineering. (PO-1, 3, 5)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination:	100	CO1, CO2, CO3, CO4, CO5

ADVANCED STRUCTURAL ANALYSIS

Course Code: MST12 **Credit: 3:1:0**
Course Coordinator: Dr. R Mourougane **Contact Hours: 42+14**

Course Content

UNIT - I

CURVED BEAMS: Introduction to curved beams & assumptions, WINKLER BACH equation, Limitation, Radius of neutral surface of rectangular, triangular sections, Trapezoidal and circular sections, Stress distribution in open curved members. Hooks etc, Problems on Hooks. Stress distribution in closed rings, Stress distribution in chain links. Deformations of open, thin curved members, Problems on thin curved members, Deformations of closed thin curved members such as rings, Problems on closed rings

Web links: https://ebookpromotions.online/nptel-design-of-curved-beam-examples.pdf

UNIT -II

BEAMS ON ELASTIC FOUNDATIONS: Differential equation of elastic line, Interpretation of constants of integration, Infinite beam with concentrated load, Infinite beam with moment & UDL, Infinite beam problems, Semi- infinite beams with Concentrated load and moment, Semi- infinite beam with fixed and hinged conditions, Problems on semi-infinite beams.

Web links: www.youtube.com/watch?v=1DutMvk--NI

UNIT -III

SHEAR CENTRE: Introduction, Shear Centre for Symmetrical Sections, Shear Centre for Unsymmetrical Sections. Derivation of shear centre for angles, channel, semicircular and built-up sections with numerical problems.

Web links: https://www.youtube.com/watch?v=PSuNyHihYgM

UNIT -IV

UNSYMMETRICAL BENDING (ASYMMETRICAL BENDING): Introduction, Assumptions, Stresses in beams, simply supported and cantilever unsymmetrical beams subjected to inclined loading, Deflections of unsymmetrical simply supported and cantilever beams with numerical problems.

Web links: www.youtube.com/watch?v=kArPZBQkBaY

UNIT - V

STABILITY- BENDING OF PRISMATIC BARS : Governing differential equation for axial and lateral loads, Problems on axial and conc. loads, Problems on axial and UDL, Beam column with different end conditions, Problems on Beam columns, **Buckling of columns** Assumptions, Euler's theory of buckling Governing differential equation, Columns with varying cross sections, Introduction to energy method and problems, Numerical method applied to column, Problems on Numerical methods.

Web links: www.youtube.com/watch?v=aglRp_PZb2Q

TEXT BOOKS

1. Krishna Raju N & Gururaj DR "Advanced mechanics of solids and structures", NAROSA Publishers Company Delhi.
2. Srinath L.S. "Advanced Mechanics of Solids", Tenth Print, Tata McGraw Hill publishing company. New Delhi, 1994.

REFERENCE BOOKS:

1. Vazirani V N and Ratwani M M "Advanced theory of structures and Matrix Method".5th Edition, Khanna publishers, Delhi 1995.
2. Hetenyi M. "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

Course Outcomes (COs):

Students will be able to

- Investigate stresses and deformations of curved beams using equilibrium and strain energy principles. (PO 1,3,4)
- Classify and solve load response behavior of beams on elastic foundations with different end conditions. (PO 1,3,4)
- Explain and solve the problems related to shear centre of symmetrical & unsymmetrical sections. (PO 1,3,4)
- Describe and solve the problems on unsymmetrical bending of beams. (PO 1,3,4)
- Explain the concept of stability and stability analysis of non-prismatic structural members with different boundary conditions. (PO 1,3,4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment/PPT	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

MECHANICS OF DEFORMABLE BODIES

Course Code: MST13 **Credit: 4:0:0**
Course Coordinator: Dr. Suguna B Rao **Contact Hours: 56**

Course Content

UNIT - I

Stress and Strain in Cartesian Coordinates: Analysis of stress (two and three dimension)-Body force, surface forces-Uniform state of stress–Principal stresses–Stress transformation laws- Differential equations of equilibrium–Analysis of strain (two and three dimension) Strain displacement relations- Compatibility equations–State of strain at a point–Strain transformations– Principal strain–Principle of superposition–Stress–Strain relations- Generalized Hook's law– Lame's constants–Methods of formulation of elasticity problems–Equilibrium equations in terms of displacements– Compatibility equations in terms of stresses– Boundary Value problems.

Web links:

https://archive.nptel.ac.in/courses/105/105/105105177/
https://www.youtube.com/watch?v=5yZNKGxe0H8
https://www.youtube.com/watch?v=_Ecda7SqDu0

UNIT -II

Two dimensional problems in Cartesian coordinate system: Introduction: Plane stress and plane strain problems–Airy's stress function–Polynomials–Direct method of determining Airy's polynomial stress Function-Solution of Bi-harmonic equation of Fourier series – St. Venant's principle.

Web links:

https://www.youtube.com/watch?v=vQq1yyj-aCE&t=205s
https://www.youtube.com/watch?v=apvhIo9jjBI
https://www.youtube.com/watch?v=K9oRJWxSPDk&t=2703s

UNIT -III

Two Dimensional Problems in Polar Coordinates: General equations in polar Coordinates-Stress distribution symmetrical about an Axis-Pure bending of curved bars- Strain components in polar coordinates–Displacements for symmetrical stress Distribution-Rotating Disc-Bending of a curved bar by force at the end–Effect of circular hole on stress distribution – A circular disc with diametric loading.

Web links:

https://www.youtube.com/watch?v=tp71tZOeitk
https://www.youtube.com/watch?v=0X6NrzyNVvk
https://www.youtube.com/watch?v=_2d8YsXwm7M&list=PL35EBF66D99E7A0EC

UNIT -IV

Torsion to Prismatic Bars: General solution of the problem by displacement (St. Venant's warping function) and force (Prandt's stress function) approaches–Membrane analogy – Torsion of shafts of circular and noncircular (Elliptic, triangular, and rectangular) cross sectional shapes– Torsion of thin rectangular section and hollow thin walled single and multicelled sections.

Web links:

https://www.youtube.com/watch?v=tKukcsUWxbg

https://www.youtube.com/watch?v=BoGiRKPDtKk

https://www.youtube.com/watch?v=HG2WIdbtTLU

UNIT - V

Introduction of Plasticity: Introduction to stress–strain curve–ideal plastic body–Criterion of yielding–Rankine's theory-St. Venant's theory–Teresa's criterion–Beltrami's theory–Von-mises criterion–Mohr's theory of yielding–yield surface–Flow rule (Plastic stress–strain relation)–Elastoplastic problems of beams in bending–Thick hollow spheres and cylinders subjected to internal pressure– General relations– Plastic torsion– perfect plasticity– Bar of circular cross section – Nadai's and heap analogy.

Web links:

https://www.youtube.com/watch?v=QV6xB0bLJwM
https://www.youtube.com/watch?v=5hQCfrJ6N38
https://www.youtube.com/watch?v=cH6nwJwRGVc

Text Books:

1. Sadhu Singh. "Theory of Elasticity" Khanna Publishers, N. Delhi, 1995.
2. T.G.Sitharam and L.Govinda Raju, "Elasticity for Engineers", I. K International Publishers, New Delhi 2017.

Reference:

1. S.P. Timoshenko and J.N. Goodier, "Theory of Elasticity," McGraw-Hill, Third Ed., New York (1970),
2. Chow P.C and Pagano N.J "Elasticity, Tensor and Engg, Approaches", D. Vannostr and co., New York 1968.
3. Timoshenko S and Goodier, J.N "Theory of Elasticity", McGraw Hill Book Co., 1951.
4. Chakrabarthy.T "Theory of Plasticity", Mc. Graw Hill Book Co., New Delhi 1988.
5. Mendelson A., "Plasticity Theory and Applications", MacMillan Co., New York 1968.

Course Outcomes (COs):

Students will be able to

- Understand the basic knowledge of elasticity and its application to stresses and strain evaluation. (PO 1,3,4)
- Identify, formulate, and solve engineering problems with respect to stress and strain through polynomials as applied to 2D and 3D elements in Cartesian coordinates. (PO 1,3,4)
- Identify, formulate, and solve engineering problems with respect to stress and strain as applied to 2D and 3D elements in polar coordinates. (PO 1,3,4)
- Identify, formulate, and solve engineering problems as applied to Torsion of Prismatic bars, and membrane analogy (PO 1,3,4)
- Identify, formulate, and solve engineering problems with respect to Plasticity. (PO 1,2,3,4,5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment/PPT	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

ADVANCED DESIGN OF CONCRETE STRUCTURES

Course Code: MSTE141 **Credit: 3:0:0**
Course Coordinator: **Contact Hours: 42**

Course Content

UNIT - I

Analysis and Design of continuous beams and portal frames. Detailing as per codes of practice.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=zG738r1JbTA
- https://www.youtube.com/watch?v=rySHRSrl5dI

UNIT -II

Analysis and Design of storage structures like silos and bunkers. Detailing as per codes of practice.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations
- Links:https://www.youtube.com/watch?v=MWaCkMs5F7w&list=PL0hmgzMMenSsXhfWeVFYZMC_JvhUQdfsF

UNIT -III

Analysis and Design concepts of waffle slabs, Design of Grid floors and Flat slabs. Detailing as per codes of practice.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=oxLP0H7HXLI&list=PLdv-Dli3YU8Lbyg_LJCMWACrZbKk4wGQ7
- Links: https://www.youtube.com/watch?v=KkxUrnocCu4

UNIT -IV

Yield line theory for analysis of slabs: Equilibrium and virtual work methods of analysis, Rectangular slabs and triangular slabs with various edge conditions -yield line patterns, Circular slabs. Design of Chain-link staircase.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links:https://www.youtube.com/watch?v=4VAjkoRkkhk&list=PLgcDuRNmTf3BgjPVKpiha6KrIAkUtxVf2&index=4
- Links:https://www.youtube.com/watch?v=BjEnmyf1G1Q&list=PLgcDuRNmTf3BgjPVKpiha6KrIAkUtxVf2&index=7

UNIT - V

Art of ductile detailing of RC structures, expansion, and construction joints in buildings.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=1d-52q6yaLo
- Links:https://www.youtube.com/watch?v=m00cSWtRK9w&list=PLcGjElsxtl-Xn2YqgKhphU09PxRwHBONL

Text Books:

1. N. Krishna Raju "Advanced Reinforced Concrete Design", CBS Publishers and distributers Pvt. Ltd., Third edition, 2017.
2. P.C. Varghese, "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2017.
3. Relevant BIS codes of practices

Reference Books:

1. Park R and Paulay T, John "Reinforced concrete structures", Wiley & Sons.
2. Fintel Mark, "Hand book on Concrete Engineering", Van Norstrand Reinhold Company.
3. Unnikrishnan Pillai & Devdas Menon "Reinforced Concrete Design", TMH Publications.

Weblinks & Videos:

- https://www.youtube.com/watch?v=pv-hiwa1veI
- https://www.youtube.com/watch?v=CjB6KBfPmDw
- https://www.youtube.com/watch?v=DFRlNG1W9gI
- https://www.youtube.com/watch?v=7liNWNokSYE
- https://www.youtube.com/watch?v=3qXuPMZMW0E&list=PLgcDuRNmTf3BgjPVKpiha6KrIAkUtxVf2&index=3

Course Outcomes (COs):

The students will be able to

- Analyze and design continuous beam, curved beam, and portal frames and to suggest practical detailing. (PO 1,2,3,4 & 5)
- Analysis and design of bunkers and silos and to suggest practical detailing. (PO 1,2,3,4 & 5)
- Analyze and design of grid slabs and flat slabs subjected to various load combinations with different boundary conditions. (PO 1,3,4)
- Analysis of slabs using yield line and strip methods and to detail them as per codes of practices. (PO 1,3,4)

- Understand and apply the engineering concept of ductile detailing in earthquake resistance buildings, expansion and construction joints in buildings. (PO 1,3,4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

EXPERIMENTAL STRESS ANALYSIS

Course Code: MSTE142 **Credit: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Strain measurement: Methods of Measurement, Calibration Load, calibration of testing machines, I.S. Course Code provisions, Measurement system, Strain measurement, Strain gauges, Principle, Types, Performance, Uses, Strain Rosettes, Wheast on Bridge, Photo Elasticity, Principle, Application, Moiré Fringe, Electronic load cells, Proving rings.

Web Links:

https://www.youtube.com/watch?v=LD-WVQiVHiQ
https://www.youtube.com/watch?v=s1WiMFQPFFo
https://www.youtube.com/watch?v=r9TMOWIsYYU

Unit II

Model Analysis: Model laws, Laws of similitude, Model materials, Model testing, Necessity for model analysis, Advantages, Applications, types of similitude, Scale effect in model, Indirect model study and direct model study, Limitations of model investigations, Structural problems demanding model studies, Usage of influence lines in model studies

Web Links:

https://www.youtube.com/watch?v=IeosmNkmugs
https://www.youtube.com/watch?v=BBImHZ8xAv0&list=PLYo9pk0CURkuzpTVVY-YCaQiDtaGROUk9

Unit III

Measurement of Vibration and Wind Flow: Measurement of vibration, Vibration galvanometers, Vibrometer, Characteristics of Structural vibration, Pressure gauge, Velocity transducers, Seismic transducers, Linear Variable Differential Transformer, Cathode ray oscilloscope, XY Plotter, Wind Tunnels, flow meters, Venturi meter, Digital Data Acquisition systems.

Web Links:

https://www.youtube.com/watch?v=DMMQmLfznxI
https://www.youtube.com/watch?v=_bfcdRhY7Rw

Unit IV

Distress Measurement and Control: Diagnosis of distress in structures, Cracks in structures, Formation of cracks, Types of cracks, Causes of cracks, Crack measurement, Monitoring and measurement of crack movement, Corrosion of reinforcement in RCC, Half-cell construction and use, Damage assessment, Controlled blasting for demolition.

Web Links:

https://www.youtube.com/watch?v=taa4Fq-fERQ&list=PLq46p_ppqQemCi6i4SvZ1kCpFREHQkF

https://www.youtube.com/watch?v=HOt-FS-6wZs

https://www.youtube.com/watch?v=ev1zMwgzpXk

Unit V

Non-Destructive Testing Methods: Load testing on structures, In situ load testing, Ultimate load testing, Rebound hammer, Principle and Applications, Limitations, Ultrasonic testing, Principles and applications, Brittle coating, Principle and Applications, Stress coat, All Temperature comparison of brittle coating, Evaluation of the coating

Web Links:

https://www.youtube.com/watch?v=qjwYcEQcJ3I&list=PLyEuOm4kr6CcUbbDD65eDMSuEC2bamPlL

Text Books:

1. Dally J.W and Riley W.F. "Experimental Stress Analysis", McGraw-Hill, Inc., New York 1991.
2. Srinath L.S. "Experimental Stress Analysis", Tata McGraw Hill publishing co., Ltd., New Delhi 1984.

References:

1. Rangan C.S. "Instrumentation – Devices and System", Tata McGraw-Hill publishing Co., Ltd New Delhi 1983.
2. Sadhu Singh, "Experimental Stress Analysis", Khanna publishers, New Delhi 1996

Course Outcomes (COs):

The students will be able to

- Apply basic knowledge of different strain instruments in the civil engineering field and various methods of measurement of strain. (PO 3 & 4)
- Ability to do the Structural problems demanding model studies. (PO 3 & 4)
- Formulate and solve engineering problems with respect to measurement of vibration and cracks that occur in civil engineering structures. (PO 3 & 4)

- Analyse structural system with modal analysis. (PO 3 & 4)
- Evaluate the strength properties by using NDT methods. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

SPECIAL CONCRETES

Course Code: MSTE143 **Credit: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Review of conventional concrete - Introduction to concrete as a construction material. Significance of properties of concrete, Aggregates - Classification types and properties of Aggregates, Artificial and recycled aggregates. Different types of Cements & its application. Hydration of Cement and Structure of hydrated Cement. Chemical and mineral admixtures.

Unit II

Microstructure of Mortar and concrete - Interfacial transition zone in concrete and its influence on strength, behavior and properties of concrete, Significance of properties of fresh and hardened concrete, Application of Nano materials in construction industry and micro fine cement. Durability of concrete - permeability, chemical attack, sulphate attack, alkali aggregate reaction, corrosion and carbonation of concrete.

Unit III

Neo Concrete: High density concrete: Materials, properties and Placement method of high-density concrete, Light weight concrete- Introduction and classification, Properties of Light weight concrete. Fiber reinforced concrete- Fibers types and properties, Behavior of FRC, Ferro cement - materials, properties and application, Recycled concrete.

Unit IV

Progress in concrete Technology: Ready mixed concrete - manufacture, transporting, placing and precautions. Proportions, properties and uses of High strength Concrete, Self-consolidating concrete, Polymer impregnated concrete, Roller compacted concrete, Porous concrete, Engineered cementations composites and smart concrete

Unit V

Special Concrete & Mix design: Pumpable concrete and its applications. Concept of mix design, variables in proportioning, exposure conditions, and procedure of mix design as per relevant codal provisions and numerical examples of mix design of Conventional concrete, Self-compacting concrete and Geopolymer concrete.

Text Books:

1. P. Kumar Mehta and Paulo J. M. Monteiro, 2006. *Concrete* - Microstructure, Properties, and Materials, 3rd Edition, McGraw-Hill,
2. M L Gambhir, *Concrete Technology*, 2009, 4th Ed., McGraw-Hill

References:

1. Paul and Pama, 1978, Ferro Cement, AIT, Bangkok
2. Neville, A.M. 1995. Properties of Concrete, 4thed. Addison Wesley Longman
3. Fafat Siddique, 2000, *Special Structural concrete*, Galgotia Publications

Course Outcomes (COs):

The students will be able to

- Define basic terminologies and describe the characteristics of basic ingredients of concrete. (PO 3 & 4)
- Explain the micro mechanism of hydration process and will be able address mechanical & durable properties of concrete. (PO 3 & 4)
- Bring out different types of concrete along with their properties for the wide range of applications in the society. (PO 3 & 4)
- Describe the commercial aspects of production, transportation and deliver system along with their merits and demerits. (PO 3 & 4)
- Design required grade of concrete using concrete mix design principles. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

COMPUTATIONAL STRUCTURAL MECHANICS

Course Code: MSTE151 **Credit: 3:0:0**

Course Coordinator: Dr. Anil Kumar R **Contact Hours: 42**

Course Content

UNIT - I

Introduction: Structural Systems, Degrees of Static and Kinematic indeterminacies, Geometrical & Material nonlinear ties, Concepts of Stiffness and Flexibility, Energy concepts in Structural Analysis, Strain Energies-Axial, Flexure & Shear, Real work and Complementary work, Principle of Virtual Displacement for a Rigid and Deformable body.

Web links:

- https://www.youtube.com/watch?v=8SjAhf4vB3k
- https://www.youtube.com/watch?v=Hn_iozUo9m4
- https://www.youtube.com/watch?v=Uazoqi9Qqus

UNIT -II

Element Flexibility Method: Flexibility matrices for Bar, Beam and Grid elements, Generation of System Flexibility Matrix using uncoupled Element Flexibility Matrices, Analysis of statically indeterminate structures – Truss, Continuous Beams and Simple Rigid Frames.

Web links:

- https://www.youtube.com/watch?v=gRj2FZGipsc&list=PLiOC1luSF9wKvtz8yNKFNKt94FtI0GJkp
- https://www.youtube.com/watch?v=gRj2FZGipsc&list=PLiOC1luSF9wKvtz8yNKFNKt94FtI0GJkp

UNIT -III

Element Stiffness Method: Relationship between Element and System coordinates, Transformation of information from System Forces to Element Forces using Equilibrium equations, Contra gradient law, Stiffness matrices for Bar, Beam and Grid elements, Generation of System Stiffness Matrix using uncoupled Element Stiffness Matrices, Analysis of statically indeterminate structures- Truss, Continuous Beams and Simple Rigid Frames.

Web links:

- https://www.youtube.com/watch?v=27G35K_KD8&list=PLYo9pk0CURkuy9VBUSm5XCnj71_WsesNJ
- https://www.youtube.com/watch?v=id3fNgxwhT8&list=PLYo9pk0CURkuy

9VBUSm5XCnj71_WsesNJ&index=5

UNIT -IV

Direct Stiffness method: Local and Global coordinate systems, Direct Assembly of Structure Stiffness matrices of truss, beam and Grid elements, Analysis of statically indeterminate structures- Truss, Continuous Beams and Simple Rigid Frames.

Web links:

- https://www.youtube.com/watch?v=4ttr1SfFgIw
- https://www.youtube.com/watch?v=IFrKPnkoLbs
- https://www.youtube.com/watch?v=wO8Le4zqQiI

UNIT - V

Storage Techniques: Half band, sky line storage, Equation solvers, Frontal solvers, Band width consideration, Algorithms and flow charts, Solution of simultaneous equations using Gauss elimination, Gauss- Seidel and Cholesky methods, Uses of commercial packages

Web links:

- https://www.youtube.com/watch?v=LHufhXH6AzA
- https://www.youtube.com/watch?v=uz9r2il7f2s&list=PL_g8xvQTzKj4Cg1_rf_qgNt1UowFOQYH

Text Books:

1. Weaver W and Gere J H, "Matrix Analysis of Framed Structures", CBS Publications, New Delhi
2. Rajasekaran S, "Computational Structural Mechanics ", PHI, New Delhi

References:

1. Pundit and Guptha, "Theory of Structures", Vol II, TMH Publications, New Delhi.
2. A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee.
3. C S Reddy, "Basic Structural Analysis", TMH Publications, New Delhi.

Weblinks & Videos:

- https://www.youtube.com/watch?v=eDb6iugi6Uk
- https://www.youtube.com/watch?v=cYzh_DVs5Q8
- https://www.youtube.com/watch?v=CPM_Z3PV44Y
- https://www.youtube.com/watch?v=vJRiTEbuMMY&list=PLYo9pk0CURkvPWiiaRn9Y8Lbj3pRO6og1
- https://www.youtube.com/watch?v=lLjjJT2QS6c&list=PLjJwBYxz7CymLLPlQKEi9Lnpv65usnkAk

Course Outcomes (COs):

Students will be able to

- Apply the concepts of flexibility and stiffness matrices (PO 3)
- Solve engineering problems with respect to flexibility matrices as applied to trusses, beams, rigid frames, and grids (PO 3,4)
- Formulate engineering problems with respect to stiffness matrices as applied to trusses, beams, rigid frames and grids (PO 3,4)
- Solve engineering problems with respect to direct stiffness methods as applied to trusses, beams, rigid frames (PO 2,3,4,5)
- Solve engineering problems with respect to various storage schemes and standard commercial packages (PO 1,2,3,4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

OPTIMIZATION METHODS IN STRUCTURAL ENGINEERING

Course Code: MSTE152 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

Introduction: Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems. **Optimization Techniques:** Classical optimization techniques, single variable optimization, multivariable optimization with no constraints, unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques.

Web Links:

https://www.youtube.com/watch?v=84HOL_EiJ4M&list=PLLtQL9wSL16ioUvHckGCkoWq_CIvyUI0p

https://www.youtube.com/watch?v=yuqB-d5MjZA

UNIT -II

Linear Programming: Linear programming, standard form of linear programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, revised simpler methods, duality in linear programming.

Web Links:

https://www.youtube.com/watch?v=FUVpa15NVcA

https://www.youtube.com/watch?v=9YKLXFqCy6E

https://www.youtube.com/watch?v=drU7dOa836M

UNIT -III

Non-linear programming: Non-linear programming, one dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, descent methods, constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems.

Web Links:

https://www.youtube.com/watch?v=0tqAEn7O0hY

https://www.youtube.com/watch?v=_wIY1nODqZs

UNIT -IV

Geometric programming: Geometric programming, conversion of NLP as a sequence of LP/geometric programming.

Web Links:

https://www.youtube.com/watch?v=0W3RgiIq3dk

UNIT - V

Dynamic programming: Dynamic programming conversion of NLP as a sequence of LP/Dynamic programming. **Structural Optimization:** Formulation and solution of structural optimization problems by different techniques.

Web Links:

https://www.youtube.com/@rayyanmerchant8231

https://www.youtube.com/watch?v=Zgvo_PJqqrg&list=PLbiOzt50Bx-lHWZvGTtoWz_QPTjIG0qRg

Text Book:

1. Rao S.S,"Optimization– Theory and Practice", Wiley Eastern Ltd

References

1. Spunt, "Optimum Structural Design", Prentice Hall
2. Uri Krisch, "Optimum Structural Design", McGraw-Hill
3. Richard Bronson, "Operation Research", Schaum's Outline Series

Course outcomes (COs):

The students will be able to

- Identify real-world objectives and constraints based on actual problem descriptions. (PO 3 & 4)
- Create mathematical optimization models. (PO 3 & 4)
- Work through proper solution techniques. (PO 3 & 4)
- Make recommendations based on solutions, analyses, and limitations of models. (PO 3 & 4)
- Search entire space of possibilities using Dynamic Programming to define optimum solution. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

DESIGN OF FORM WORKS

Course Code: MSTE153 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

Form Materials and Pressures on Formwork: Lumber – Types – Finish – Sheathing boards - Working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminum Form lining materials – Hardware and fasteners – Nails in Plywood – Bolts lag screw and connectors – Bolt loads. Pressures on Formwork - Concrete density – Height of discharge – Temperature – Rates of Placing – Consistency of concrete – Live loads and wind pressure – Vibration Hydrostatic Adjustment for non-standard condition.

UNIT - II

Shores and Form Design: Simple wood stresses – Slenderness ratio – Allowable loads – Tubular steel shores - Patented shores – Site Preparation - Size and spacing – Steel Tower Frames – Safety practices – Horizontal shoring for multi-levels – More concentrated shore loads - T-heads – Two tier wood shores – Ellis shores – Dayton sure grip and Baker Roos shores – Safway Symons shores – Beaver Advance shores - Dead shores – Raking and Flying shores Basic simplification – Beam formulas – Allowable stresses

UNIT-III

Planning, Site Equipment and Plant for Form Work: Overall Planning – Detailed Planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning at Tender stage – Development of basic system – Planning for maximum reuse – Economical form construction – Planning examples – Crane size, effective scheduling estimate – Recheck plan details – Detailing the forms. Crane arrangement – Site layout plan – Transporting plant – Formwork beams – Formwork ties – Wales – Scaffold frames - Form accessories – Vertical transport table form work.

UNIT - IV

Deflection bending lateral stability – Shear, Bearing – Examples in wall forms – Slab forms – Beam form – Ties, Anchors and Hangers – Column forms – Examples in each.

UNIT – V

Dome Forms, Tunnel Forms, Slipforms and Safety Practices for Scaffolds:

Shells of translation and revolution - Hemispherical – Parabolic - Barrel vaults – Hypar Shells – Conoidal Shells - Folded plates – Shell form design – Building the form – Placing concrete – Strength requirements – Tunnel forming components – Curb and Invert forms.

Text Books:

1. Robert L. Peurifoy and Garold D. Oberlender, "Formwork for Concrete Structures", Third Edition McGraw-Hill, 1996.
2. Hurd, M.K., "Formwork for Concrete", Special Publication No. 4 Sixth Edition, American Concrete Institute, Detroit, 1995.

Reference Books:

1. Michael P. Hurst, "Formwork", Construction Press, London, and New York, 1997.
2. Austin, C.K., "Formwork for Concrete", Cleaver – Hume Press Ltd., London 1996.
3. Tudor Dinescu and Constantin Radulescu, "Slip form Techniques", Abacus Press, Turn Bridge Wells, Kent, 1992.
4. "Guide for Concrete Formwork", American Concrete Institute Detroit, Michigan, 1996.
5. "Safety Requirements for Scaffolding", American National Standards Institute, New York, 1994.

Web links:

https://www.youtube.com/watch?v=KFqtas8YhVE&list=PLAH7b05Vz14G8Q4CA_ufs19oethxX86K9

https://www.youtube.com/watch?v=p5lzixbac6k&list=PLAH7b05Vz14G8Q4CA_ufs19oethxX86K9&index=2

https://www.youtube.com/watch?v=iyti0sjlnIQ&list=PLAH7b05Vz14G8Q4CA_ufs19oethxX86K9&index=5

Course outcomes (COs):

The students will be able to

- Understand the behavior of form work material and pressures acting on formwork. (PO 1,3,4 &5)
- Design formwork and Shores (PO 1,2,3,4 &5)
- Design a system, component, or process as per needs and specifications of formwork and scaffolding elements such as beams, slabs, columns and

footings subjected to various load combinations with different boundary conditions. (PO 1,3,4 &5)

- Analyze, design and detail the formwork and scaffolding elements for strength and durability. (PO 1,3,4 &5)
- Understand about Dome Forms, Tunnel Forms, Slip forms and Safety Practices for Scaffolds. (PO 1,3,4 &5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

RESEARCH METHODOLOGY & IPR

Course Code: RMI16 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

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, Problems encountered by researchers in India.

Defining the Research Problem: What is a research problem, Selecting the problem, Necessity of defining the problem, the Technique involved in defining a problem, An illustration.

UNIT - II

Literature review: Primary and secondary sources, Reviews, Monograph, Patents, Research databases, Web as a source, Searching the web, Critical literature review, Identifying gap areas from literature and research database, Development of working hypothesis.

Research Design: Meaning of research design, Need for research design, Features of a good design, Importance concepts relating to research design, Different research designs, Basic principles of experimental design.

UNIT-III

Sampling Design- Census and sampling survey, Implications of a sample design, Steps in sampling design, Criteria of selecting a sampling procedure, Characteristics of a good sample design, Different types of sample designs, How to select a random sample, Random sample from an infinite universe, Complex random sampling designs.

Methods of Data Collection- Collection of primary data, Observation method, Interview method, Collection of data through questionnaires, Collection of data through schedules, Differences between questionnaires and schedules, some other methods of data collection, Collection of secondary data, Selection of appropriate method for data collection, Case study method.

UNIT - IV

Multivariate Analysis: The nature of the multivariate analysis, Classifying multivariate techniques, Analysis of dependence, Analysis of interdependence.

Probability distributions: Introduction to Probability, Laws of Probability, Baye's theorem, Discrete and Continuous random variables, Binomial, Poisson distributions, Normal and Exponential distributions - Simple problems, applications

UNIT – V

Research Ethics and Intellectual Property: Ethics- Ethical issues, Ethical committees (human & animal), Research ethics; IPR- Intellectual property rights and Patent law, Commercialization, Copyright, Royalty, Trade-related aspects of intellectual property rights (TRIPS); Scholarly publishing- IMRAD concept and design of research paper, Citation and acknowledgement, Plagiarism, Reproducibility and Accountability.

Text Books:

1. Kothari CR and Garg G. 2019. Research Methodology: Methods and Techniques, Fourth Edition, New Age International Publishers, ISBN (13): 978- 81-224-2488-1.
2. Panneerselvam R. 2013. Research Methodology, Second Edition, Prentice Hall India Learning Private Limited, ISBN (13): 978-8120349469.

Reference Books:

1. Zikmund WG, Babin BJ, Carr JC and Griffin M. 2013. Business Research Methods, Ninth Edition, Cengage India Private Limited, ISBN (13): 978- 9353503260.
2. Wadhera BL. 2010. Law Relating to Intellectual Property: Patent, Trademarks, Designs and Geographical Indication, Universal Law Publishing, ISBN: ISBN: 978-9350350300.

Course outcomes (COs):

The students will be able to

1. Understand the research methodology and define the problem for research.
2. Conduct a literature review and apply the principles of research design.
3. Apply the knowledge of various sampling procedures and different methods of data collection in the research.
4. Apply multi-variate techniques and concepts of probability distributions to real- time situations
5. Apply ethics and concepts of intellectual property in the research process.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

ADVANCED CONCRETE LABORATORY

Course Code: MSTL17 **Credit: 0:0:1**
Course Coordinator: Dr. Nambiyanna B and Dr. Lakshmikanth S **Total session: 14**

Course Content

1. Mix proportion and fresh properties of normal strength concrete
2. Mix proportion and fresh properties of high strength concrete
3. Mix proportion and fresh properties of self-compaction concrete with and without Steel fibers
4. Mechanical properties of normal strength concrete
5. Mechanical properties of high strength concrete
6. Mechanical properties of self-compaction concrete
7. Flexural behavior of reinforced concrete beams
8. Shear Behavior of reinforced concrete beams
9. Effect of elevated temperature on Normal and High Strength Concrete with and without fibers
10. Load-deflection characteristics of Steel Fiber Reinforced Concrete Beams

Text Books:

1. Shetty M.S, 'Concrete Technology', S. Chand & Co. Ltd, New Delhi.
2. Mehta P.K, 'Properties of Concrete', Tata McGraw Hill Publications, New Delhi.

Reference Books:

1. Neville AM, 'Properties of Concrete', ELBS Publications, London.
2. Relevant BIS codes.

Web links:

- https://www.youtube.com/watch?v=TZPoRXEM4YQ
- https://www.youtube.com/watch?v=-DLyJCV_iHM
- https://www.youtube.com/watch?v=7ZgGGKg-yfQ
- https://www.youtube.com/watch?v=W0hZsM9ytIU
- https://www.youtube.com/results?search_query=properties+of+concrete+in+civil+engineering
- https://www.youtube.com/watch?v=rPn734g3Psw
- https://www.youtube.com/results?search_query=fresh+concrete
- https://www.youtube.com/watch?v=6zUgbZGhvA0&list=PLyEuOm4kr6CdNoJUWh4VpFMkwdhc30qSi

- https://www.youtube.com/watch?v=2IrIiX1edWI
- https://youtu.be/-iPfQvQgEZw
- https://youtu.be/kn55JTfulmc
- https://youtu.be/R_z3gn1p-9g

Course outcomes (COs):

The students will be able to

- Proportion and evaluate the fresh properties of Normal and High-strength concrete. (PO2, PO3, PO4)
- Proportion and evaluate the fresh properties of Self-compacting concrete, with and without steel fibers. (PO2, PO3, PO4)
- Mechanical properties characterisation of Normal, High-strength and Self Compacting concrete. (PO2, PO3, PO4)
- Analyze the load deflection characteristics of reinforced and Fibre reinforced concrete beams. (PO1 PO2, PO3, PO4)
- Assess the effect of elevated temperatures on concrete with and without fibers on their mechanical properties. (PO1 PO2, PO3, PO4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Weekly evaluation of laboratory Drawings and Files after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation (SEE): 50 Marks		
Semester end examination	50	CO1, CO2, CO3, CO4 & CO5

NON DESTRUCTIVE TESTING LABORATORY

Course Code: MSTL18 **Credit: 0:0:1**
Course Coordinator: Dr Anil Kumar R **Total Session:14**

Course Content

List of Experiments

1. Rebound hammer test on concrete.
2. Ultra-Sonic Pulse Velocity test on concrete members.
3. Carbonation test on concrete.
4. Corrosion test on concrete.
5. Measurement of shrinkage in concrete.
6. Usage of Profometer for reinforcement profile analysis.
7. Tests on concrete at elevated temperature under controlled condition
8. Permeability test on concrete
9. Rapid Chloride Penetration Test on concrete
10. Condition survey

Text Books

1. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures–Materials, Maintenance and Repair"- Longman Scientific and Technical

Reference Books:

1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons.
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).
3. CPWD Hand book on Rehabilitation of Structures.

Web links:

https://www.youtube.com/watch?v=83AcFYK-Eno&t=45s
https://www.youtube.com/watch?v=M9hkvS_OLmk
https://www.youtube.com/watch?v=MKOmqaEvNU8
https://www.youtube.com/watch?v=2T_igvRbdzg
https://www.youtube.com/watch?v=bv7uhnNuovY
https://www.youtube.com/watch?v=t7VECXndNao
https://www.youtube.com/watch?v=MM8JQZPztck
https://www.youtube.com/watch?v=ZDTk6T3V26o
https://www.youtube.com/watch?v=DU4c5eOBMhk

Course Outcomes (COs):

The students will be able to

- Carry out the inspection of distressed structures to observe and record comprehensive information about the distress and prepare structural evaluation report. (PO 1,2,3,4)
- Use Rebound Hammer, ultra-sonic pulse velocity to evaluate strength and quality of concrete .(PO 1,2,3,4)
- Measure shrinkage, creep and permeability in concrete. (PO 1,2,3,4)
- Detect reinforcement, its diameter and measure corrosion and carbonation of rebars in RC members. (PO 1,2,3,4)
- Evaluate the concrete by semi destructive method - Core Sampling. (PO 1,2,3,4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Weekly evaluation of laboratory Drawings and Files after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation (SEE): 50 Marks		
Semester end examination	50	CO1, CO2, CO3, CO4 & CO5

THEORY OF PLATES AND SHELLS

Course Code: MST21 **Credit: 3:1:0**
Course Coordinator: Dr. R Mourougane **Contact Hours: 42+14**

Course Content

UNIT -I

INTRODUCTION: General behavior of plates, Assumptions, small deflection theory of thin plates, governing differential equation for deflection of plate, Boundary conditions, Bending of Isotropic Rectangular plates: Navier solution for an all-round simply supported rectangular plate subjected to uniformly distributed load, sinusoidal load and point load, Levy's solution for a rectangular plate with different boundary conditions and subjected to uniformly distributed load.

Web Links: https://archive.nptel.ac.in/courses/105/103/105103209/

UNIT -II

BENDING OF CIRCULAR PLATES: Symmetrical bending of circular plates, simply supported solid circular plate subjected to an uniformly distributed load, an end moment and partially distributed load.

Web Links: https://archive.nptel.ac.in/courses/105/103/105103209/

UNIT -III

DESIGN OF FOLDED PLATE ROOFS: Structural behavior of folded plates, Assumptions, Analysis of folded plates, Design of prismatic folded plate roofs.

Web Links: pdhonline.com/courses/s275/s275content.pdf

UNIT -IV

INTRODUCTION TO THEORY OF SHELL STRUCTURES: Structural behavior of thin shells, General classification of shell surfaces, Analysis of shells like conoid, hyperbolic and elliptic paraboloids.

Web Links: https://archive.nptel.ac.in/courses/105/103/105103209/

UNIT - V

BENDING THEORY OF SHELLS: Introduction of differential geometry of curves and surfaces, classification of shells, beam theory, membrane theory, bending theory for symmetric shells, Membrane theory of shells of revolutions, domes, hyper boloid of revolution.

Web Links: https://archive.nptel.ac.in/courses/105/103/105103209/

Text Books:

1. Szilard R., "Theory and Analysis of Plates–Classical and Numerical Methods", Prentice Hall Inc 1995.
2. Timoshenko S. and Kreiger S.W., "Theory of Plates and Shells".,McGrawHill Books Company, Newyork-1990.

References:

1. Chandrashekhara K, "Theory of Plates" Universities Press (India) Ltd., Hyderabad 2001.
2. Ansel C.Ugural, "Stresses in Plates and shells", Second Edition, McGraw-Hill International Editions 1999.

Course Outcomes (COs):

The students will be able to

- Behaviour of rectangular plates by Navier and Levy's solution subjected to various types of loads. (PO1,3&4)
- Evaluate the circular plates for different end conditions subjected to various types of loads. (PO1,3&4)
- Analyze and design of folded plates. (PO1,3&4)
- Analyze the components of various types of thin shells. (PO1,3&4)
- Analyze the shells using bending and membrane theory. (PO1,3&4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment/PPT	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

STRUCTURAL DYNAMICS

Course Code: MST22 **Credit: 3:1:0**
Course Coordinator: Dr. Basavanagowda G M **Contact Hours: 42+14**

Course Content

Unit I

Introduction to Free vibrations of SDF systems

Objectives, Types of Dynamic Analysis, Types of Dynamic forces, typical definitions in vibrations, Undamped and Damped free vibrations with viscous damping, Logarithmic decrement, other types of damping, Energy dissipation in free vibration.

Pedagogy/Course delivery tools: Chalk and Talk/Power point presentations

Types of dynamic loads: Links: http://surl.li/ufrwy
Vibration of SDOF system :http://surl.li/ufrxm
Dynamic Equilibrium Equation:http://surl.li/ufrxt

Unit II

Forced vibrations of SDF systems

Forced vibration response to harmonic excitations of damped and undamped system, Vibration isolation, Transmissibility, Evaluation of damping, Energy dissipation, Principles of Vibration measuring instruments-Seismometer and Accelerometer.

Pedagogy/Course delivery tools: Chalk and Talk/Power point presentations

Forced vibration response to harmonic excitations: https://rb.gy/go56jz
Links: https://rb.gy/gm8wh6

Unit III

Response to Arbitrary loadings

Response to Periodic forces, Duhamel's Integral and Response of SDOF systems to various loading cases- Constant Force, Rectangular Pulse, Triangular, linearly varying load, Numerical problems.

Pedagogy/Course delivery tools: Chalk and Talk/Power point presentations

Links: https://rb.gy/gm8wh6
Duhamel Integral: https://www.youtube.com/watch?v=az6VJw9uX1s

Unit IV

Free vibrations of MDF systems

Formulation of equations of motion for shear buildings, Free vibration analysis of undamped systems using stiffness approach, Orthogonality conditions, Normal modes, Matrix iteration method, Damping in MDF systems and evaluation of damping matrices, Rayleigh's and Dunkerley's method to calculate fundamental natural frequency

Pedagogy/Course delivery tools: Chalk and Talk/Power point presentations

Unit V

Forced Vibrations of MDF systems and Free Vibrations of Continuous systems

Forced Vibration analysis using model superposition method and simple pulse loadings including base excitations, free flexural vibrations of beams with different end conditions and axial vibrations of continuous systems and application to single span systems

Pedagogy/Course delivery tools: Chalk and Talk/Power point presentations

Analysis of Continuous system: https://rb.gy/v3o95y

Forced vibration of MDOF systems:https://www.youtube.com/watch?v=2R41rRfi_sE

Text Books:

1. Mario Paz, Structural Dynamics, CBS Publishers, New Delhi
2. Anil K Chopra, Dynamics of Structures, Pearson Publications, New Delhi

References:

1. Madhujit Mukhopadyay, Vibrations, Dynamics and Structural Systems, Oxford Publishers, New Delhi
2. Clough and Penzein, Dynamics of Structures, Mcgraw Hill Publishers, New York
3. Rao S.S, Mechanical Vibrations, Pearson Publications, New Delhi
4. Leonard Meirovitch, Elements of Vibration Analysis, Tata Mcgraw Hill, New Delhi
5. Roy Craig, Structural Dynamics, John Wiley Publications, New York

Course Outcomes (COs):

The students will be able to

- Evaluate the damping present in structural systems and apply the knowledge of energy absorption mechanisms to minimize the vibration of structural systems. (PO1, 2,3& 4)
- Identify, formulate, and solve problems of transmissibility of forces to foundations of structural systems (PO1, 2,3 & 4).
- Analyze the SDOF System subjected to arbitrary loadings (PO 1,3&4)
- Analyze the MDOF shear buildings and their performance to dynamic loadings (PO1, 2,3, 4 & 5).
- Assess the impact of arbitrary loadings on the dynamic performance of structures and behavior of continuous systems subjected to flexural vibrations (PO1,3 & 4).

Web Links:

1. Introduction to Structural Dynamics: https://rb.gy/k1dd71
2. Modelling of dynamic systems:https://rb.gy/wnq1sn
3. Response of Structures to different loads: http://surl.li/ufsjj

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	**Marks**	**Course outcomes mapped**
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

FINITE ELEMENT METHOD IN STRUCTURAL ANALYSIS

Course Code: MST23 **Credit: 4:0:0**
Course Coordinator: Dr Suguna B Rao **Contact Hours: 56**

Course Content

UNIT - I

Introduction: 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. Principles of finite element method Advantages & Disadvantages-Finite element procedure. Finite element used for one, two & three dimensional problems–Element aspect ratio–mesh refinement vs. higher order elements–Numbering of nodes to minimize band width.

Web Links:

https://www.digimat.in/nptel/courses/video/112104193/L01.html
https://www.youtube.com/watch?v=skvY_RAKD_E

UNIT -II

Displacement Model: 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.

Web Links:

https://www.youtube.com/watch?v=0VNIEfX0m4A
https://www.youtube.com/watch?v=WL75T7iCSaA

UNIT – III

Concept of 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– Variation method and minimization of Energy approach of element formulation (Development of strain–displacement matrix and stiffness matrix)– consistent load vector– numerical integration.

Web Links:

https://www.youtube.com/watch?v=5WlTQRtMCMM
https://www.youtube.com/watch?v=ir7DY0y7O-g

UNIT -IV

Application of Finite Element Method for the analysis of one-dimensional problems: Analysis of simple beams and plane trusses and rigid plane frames.

Web Links:

https://www.youtube.com/watch?v=NdceDyMqTZU

https://www.youtube.com/watch?v=7Z9v_tDxhLk&list=PLnT2pATp7adU_OYwrPoDWE_YmePxu-fMf

UNIT – V

Application of Finite Element Method for the analysis of two dimensional problems: Application to plane stress/ strain/ axisymmetric problems using CST, LST &Quadrilateral elements. Choice of displacement function (C_0, C_1 and C_2Type) for plate and shell elements.

Web Links:

https://www.youtube.com/watch?v=_LYZasFk73c

https://www.youtube.com/watch?v=fMBSvORu7FQ

Text 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

References

1. Bathe K J, "Finite Element Procedures in Engineering Analysis", Prentice Hall, 1982.
2. Rajasekaran. S, "Finite Element Analysis in Engineering Design", Wheeler Publishing, 1999.
3. Cook R D, Malkan D S &Plesta M.E, "Concepts and Application of Finite Element Analysis", 3rd Edition, John Wiley and Sons Inc., 1989
4. Shames I Hand Dym C J, "Energy and Finite Element Methods in Structural Mechanics", McGraw Hill, New York, 1985

Course Outcomes (COs):

The students will be able to

- Describe finite element analysis applied to structural systems (PO1, 3, 4 & 5)
- Identify, formulate and solve engineering problems related to one, two and three dimensional elements. (PO1, 3, 4 & 5)
- Identify, formulate and solve engineering problems related to one, two and three dimensional isoparametric elements. (PO1, 3, 4 & 5)
- Apply FEM analysis to one dimensional problem such as beams, trusses &rigid frames. (PO 1, 3, 4 & 5)
- Apply FEM analysis to two dimensional problems such as plates, shells and axi-symmetric problems. (PO1, 3, 4 & 5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	**Marks**	**Course outcomes mapped**
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

REHABILITATION AND RETROFITTING OF STRUCTURES

Course Code: MSTE241 **Credit: 3:0:0**
Course Coordinator: Mrs Lakshmi H S **Contact Hours: 42**

Course Content

UNIT– I

Durability and Deterioration: Physical causes: Durability of concrete causes of distress in concrete, sulphate attack, shrinkage, freezing and thawing, weathering, abrasion, temperature, fire, formwork movement, settlement, foundation settlement, construction errors, overloads, accidental loadings and design errors.

Chemical causes: Chemical attack on concrete, sulphate attack, acid attack, alkali reaction, aggregate reaction, silica reaction, crystallization of salts in pores, sea water attack, biological attack, other chemical attacks.

Web links: **https://youtu.be/MiLaklmfubY?si=aU-lHx3IYAviq0ta**
https://youtu.be/xlmiCWaYHXk?si=fozCRUSi-yIpsLxU

UNIT– II

Structural Damage Assessment: Inspection, Structural Appraisal, Economic appraisal, components of quality assurance, conceptual basis for quality assurance schemes. Assessment of damage due to fire.

Corrosion: Principle of corrosion, mechanism, process, damage due to corrosion, codal provisions, symptoms of distress due to corrosion, corrosion protection techniques.

Web links: **https://youtu.be/jWYGm-945BE?si=YK4ZPRqLtAQ5lXqA**
https://www.youtube.com/watch?v=9E5UiEenKkM

UNIT– III

Functional Materials for Repair and Rehabilitation: Criteria for selecting repair materials, classification of materials, physical and chemical strength tests, adhesive strengths and test for surface quality. Patching materials, cementitious materials, polymer mortar and concrete, quick setting compounds, bituminous materials, protective coatings, sealing materials, water stops, water proofing materials, coatings, membranes, bonding materials. Special repair materials, chemicals and mineral admixtures, SP, accelerators, fly ash, GGBS, CSF, polymeric materials and coatings, SFRC, application of SFRC to repair, FRF composites, Ferro-cement, glass fibers, carbon fibers SIFCON, SIMCON, Slurry Infiltrated Fibrous Concrete, Nano materials for rehabilitation.

Web links: **https://youtu.be/JuRUXEV6Qmw?si=SAbVPBBJ1QDCluB4**
https://youtu.be/EvSSktNW028?si=HQUI94MPXJeNrBZU

UNIT–IV

Rehabilitation and Strengthening Techniques: Repair of cracks, methods of repair, and stages of repair, resin injection, routing and sealing, stitching, external stressing, bonding, blanketing, overlays, flexible sealings, drilling, plugging, surface coatings, **grinding, sand blasting**. Gunite and shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Structure concrete strengthening, jacketing, external bonding, section enlargement, externally bonded steel plates, external reinforcement, NSM techniques.

Web links: https://youtu.be/ZHVXWxEFqWI?si=p6DrfglsCpyMf2Jp
https://youtu.be/LK3jZJv7pAQ?si=X05g8rwz1PZmqJ_u

UNIT–V

Maintenance: Definition, necessity of maintenance, classification of maintenance, environmental agencies, normal wear and tear, failure of structures, inspection of structures, inspection periods, preventive maintenance, predictive maintenance, reliability centered maintenance, reactive maintenance, organization for maintenance, computerized maintenance management system. Condition of flooring, roof leakage, Condition of service fittings, drainage from terrace roof, growth of vegetation, steps to reduce repairs and replacement, normal breakup, management tools for effective maintenance.

Web links: https://youtu.be/x9noZ4xEXyg?si=5GirBnMTxYAUvldR
https://youtu.be/W1Z3cnZUUz0?si=PZlXdtjLLc7SyNKc

Text Books:

1. J. Bhattacharjee, Concrete Structures - Repair, Rehabilitation and Retrofitting CBS Publisher and Distributors Pvt. Ltd., 2017.
2. P K Mehta and PJM Monteiro, Concrete - Microstructure, Properties and Materials, Mc Graw Hill education Pvt. Ltd., 2014.

Reference Books:

1. Dension Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical, U.K, 1991.
2. RT. Allen and S.C. Edwards, “Repair of concrete Structures”, Blakie and sons, UK, 1987.
3. “Training course notes on damage assessment and Repair in low cost housing Santha kumar”, S.R. RHDC-NBO Anna University, Madras, July, 1992.
4. “ CPWD hand book for Rehabilitation of structures”
5. Relevant Indian, American and British codes of practices.

Web links:

https://youtu.be/lygj7PZprbY?si=URhbqxOXk1Tkk5iY
https://youtu.be/xvjmvNUcX00?si=Udy5qTbaTLeZHSQO
https://youtu.be/DZVb78ebu5k?si=coMGDojkdnu_pFr3
https://youtu.be/4RrStzAoDQ0?si=dSD8vkXvlUl8Wc2Q
https://youtu.be/ZnRZuVz1p-c?si=I_srSxVkBT1GFKRR

Course Outcomes (COs):

The students will be able to:

- Understand the concept of durability and deterioration of structures and to apply them to interpret the structural behavior. -PO1,2,3,4&5
- Inspect and appraise the structural damage and to assess the engineering performance using smart instruments. PO1,2,3,4&5
- Understand the engineering properties of functional and repair materials and to suggest them for practical requirements. PO1,2,3,4&5
- Comprehend the engineering knowledge of strengthening techniques and to suggest the solutions for practical application. PO1,2,3,4&5
- Apply the maintenance procedure based on quality inspection techniques to civil engineering structures. PO1,2,3,4&5

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	**Marks**	**Course outcomes mapped**
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project Work/Presentation	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

ADVANCED PRESTRESSED CONCRETE

Course Code: MSTE242 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT I

Introduction to PSC: Pre-stressing systems, Analysis of pre-stress and Bending stress, losses of pre-stress of beams, Deflection of pre-stressing beams, Concept of load Balancing.

Web Link: https://ebookpromotions.online/nptel-design-of-curved-beam-examples.pdf

UNIT II

Design of Circular Pre-Stress: Introduction, Design of Pre-stressing Pipes, Design of One-way and Two way slabs.

Web Link: www.youtube.com/watch?v=1DutMvk--NI

UNIT III

Design of Pre-Stressed Bridges: (Super-structure only), Types of bridges, Special Construction technique for bridges, Provision in IRC code. Design Principles. Design problems.

Web Link: https://www.youtube.com/watch?v=PSuNyHihYgM

UNIT IV

Design of PSC Elements: Design of PSC Continuous beams. Design of Pre-stressed concrete Poles, Pavements and Sleepers.

Web Link: www.youtube.com/watch?v=kArPZBQkBaY

UNIT V

Design of Tension and Compression PSC Member: Design of tension member with numerical problems, compression members with numerical problems.

Web Link: www.youtube.com/watch?v=aglRp_PZb2Q

Text Books:

1. Krishna Raju N, “Pre - stressed Concrete”, Tata Mcgraw Hill, New Delhi
2. Rajagopalan N, “Pre - stressed Concrete. Narosa Publishing House, New Delhi

Reference books:

1. Lin T Y and Burns N H, Design of Pre - stressed Concrete Structures“ , John Wiley and Sons, New York
2. Pundit G S and Gupta S P, Pre - stressed Concrete, C B S Publishers, New Delhi.

Course Outcomes (Cos)

The students will be able to

- Understand the basic principles of Pre-stressing. (PO 3 & 4)
- Analyze and design of circular systems, pipes and slabs. (PO 3 & 4)
- Design of Pre-stressed Bridges. (PO 3 & 4)
- Design of continuous beams, poles pavements and sleepers. (PO 3 & 4)
- Design of tension and compression members. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

FRACTURE MECHANICS

Course Code: MSTE243 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

Elastic Crack Model: Fundamentals of the Theory of Elasticity and Indicial Notations. Elastic Stress Field at Crack Tip, William‟s Problem, Stress Intensity Factors, Fracture Toughness, Different Modes of fracture, Direction of Crack Propagation.

Web Links: https://youtu.be/4Nn0t8ljuf8

https://www.youtube.com/watch?v=FFtqLDc8WxI

UNIT II

Griffith Energy Balance & Plasticity Effects: Basic Energy Balance, Fixed Grip and Fixed Force Conditions, Strain Energy Release Rate, Experimental Calibration. Elementary estimates of Size and Shape of Plastic Zones, Plasticity Correction Factor, Plane Strain vs. Plane Stress Conditions, Dugdale Model, Crack Tip Opening, J-integral and its Applications.

Web Links: https://youtu.be/gcYJ4jGYojo

https://youtu.be/tcmyN1fPkFM

UNIT -III

Applied Fracture Mechanics: 3-D Effects at the Crack Front, Fatigue Crack Growth, Penny and Elliptical Shaped Flaws, Part-Through Surface Cracks, Summary and Relevant Crack Tip Stress Intensity Factors.

Web Links: https://www.youtube.com/watch?v=X7PGu5ljRX0

https://youtu.be/wZhX_-m6Zdk

UNIT –IV

Analytical Stress Analysis: Westergaard Stress Function. Advanced Topics: Fracture Toughness of Fiber Reinforced Brittle Matrix Composites, Stress Intensity Factors at Crack Corners, Interface Cracks.

Web Links: https://www.youtube.com/watch?v=7n1vXTTimTI

https://www.youtube.com/watch?v=bDKeJ63V3rg

UNIT - V

Numerical Stress Analysis: Boundary Collocation, Conventional Finite Elements, Special Crack Tip Elements, Quarter Point Eight Node Iso parametric Elements.

Web Links: https://www.youtube.com/watch?v=f1JUfXf2b8A

Text Books

1. K. Hellan, Introduction to Fracture Mechanics, McGraw-Hill, 1984.
2. D. Broek, Elementary Engineering Fracture Mechanics, 4thRevised Edition, Kluwer Academic Pub., 1991.

References

1. G. Sih, Handbook of Stress Intensity Factors, CBS Publications, New Delhi
2. T. Anderson, Fracture Mechanics, CRC Publications, New York

Course outcomes (COs):

Students will be able to

- Understand basic knowledge of fracture mechanics and elastic crack model.(PO1, 3, 4 & 5)
- Apply the knowledge of Griffith Energy Balance & Plasticity Effects in the analysis of structures.(PO1, 3, 4 & 5)
- Analyze the Fatigue crack growth and relevant crack tip stress intensity factors.(PO1, 3, 4 & 5)
- Evaluate the Toughness of fiber reinforced brittle mix composites.(PO1, 3, 4 & 5)
- Analyze the Iso parametric elements for different stresses.(PO1, 3, 4 & 5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

DESIGN OF CONCRETE BRIDGES

Course Code: MSTE251 **Credit: 3:0:0**
Course Coordinator: Mr. Raje Gowda **Contact Hours: 42**

Course Content

UNIT - I

Introduction & Design of Slab Culvert: Historical Developments, Selection for Bridges, Classification of Bridges, Forces on Bridges, Dead load BM & SF for IRC 70R Tracked and Wheeled, IRC Class A Loading, BM & SF Structural Design of Slab Culvert, Reinforcement Detail.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://archive.nptel.ac.in/courses/105/105/105105165/

UNIT -II

Box Culvert: Loading Cases, IRC 70R Tracked and Wheeled, IRC Class A Loading, Structural Design of Box Culvert, Reinforcement Detail.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://archive.nptel.ac.in/courses/105/105/105105165/

UNIT -III

T Beam Bridge: Slab Design: Proportioning of Components, Analysis of Slab using IRC 70R Tracked and Wheeled, IRC Class A Loading, Structural Design of Slab. **Cross Girder:** Analysis of Cross Girder for Dead Load & IRC 70R Tracked and Wheeled & Class A Loads, Structural Design of Cross Girder. **Main Girder:** Analysis of Main Girder Using COURBON'S Method for IRC 70R Tracked and Wheeled vehicle for BM, Calculation of Live load SF, Calculation of Dead load BM and SF, Structural Design of Main Girder.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://archive.nptel.ac.in/courses/105/105/105105165/

UNIT -IV

PSC Bridge: Introduction to Pre & Post Tensioning, Proportioning of Components, Analysis & Design of Slab, Main Girder Using COURBON'S Method for IRC 70R Tracked, Calculations of Prestressing Force, Calculations of Stresses, Cable profile, Design of End Block, Detailing of Main Girder. Design concepts of segmental bridge.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://archive.nptel.ac.in/courses/105/105/105105165/
- Links: https://onlinecourses.nptel.ac.in/noc24_ce79/course

UNIT - V

Balanced Cantilever Bridge: Introduction & Proportioning of Components, Design of Simply Supported Portion, , Design of Cantilever Portion, Design of Articulation, Reinforcement Details of Main Girder

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://youtu.be/3PPDQ3L64do?si=aYDy5gixt1hEKiTT

Text Books:

1. Essentials of Bridge Engineering by Dr D Johnson Victor, Oxford & IBH Publishing Co New Delhi
2. Design of Bridges by Dr N Krishna Raju, Oxford &IBH Publishing Co New Delhi

References:

1. Principles and Practice of Bridge Engineering by S P Bindra, Dhanpat Rai & Sons New Delhi
2. IRC6-2017 Standard Specifications and Course Code of Practice for Road Bridges Section II Loads and Stresses, The Indian Road Congress New Delhi
3. IRC21-2000 Standard Specifications and Course Code of Practice for Road Bridges Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
4. IS456-2000 Indian Standard Plain and Reinforced Concrete Course Code of Practice (Fourth Revision) BIS New Delhi
5. IS 1343- Indian Standard Prestressed Concrete Course Code of Practice, BIS New Delhi

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=zUL9bq3KENA
2. https://www.youtube.com/watch?v=1ivH4z4Pn-E
3. https://www.youtube.com/watch?v=Wh8_M79bOMk&list=PLWGuJwIkWb_SnhVrRHkbnxe4ehRktxfrz

Course Outcomes (COs):

The students will be able to

- Analyze and solve engineering problems in design of slab culvert subjected to flexure, shear and torsion. (PO1, 2, 3, 4 & 5)
- Analyze and solve engineering problems in design of box culvert subjected to flexure, shear and torsion. (PO1, 2, 3, 4 & 5)
- Demonstrate the procedural knowledge to design a system component as per needs and specifications of T- beam bridges subjected to various load combinations. (PO1, 2, 3, 4 & 5)
- Analyze and Design of Pre-tensioned as well as Post-tensioned slabs, girders subjected to various load combinations. (PO1, 2, 3, 4 & 5)
- Analyze and design the components of balanced cantilever bridges. (PO1, 2, 3, 4 & 5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

STABILITY ANALYSIS OF STRUCTURES

Course Code: MSTE252 **Credit: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Beam - Column: Differential equation, Beam column subjected to (i) lateral concentrated load, (ii) several concentrated lateral load, Applications of trigonometric series, Euler's formation using fourth order differential equation for pinned- pinned, fixed -fixed, fixed- free and fixed - pinned column.

Web Links:

https://www.youtube.com/watch?v=Y66Y6ksLP6Y

https://www.youtube.com/watch?v=79Z1SQXfE-k&list=PLNKD1qB9pptuSCL1-RpGm_o8YW6L_xaFs

Unit - II

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 and pulsating forces.

Web Links:

https://www.youtube.com/watch?v=u3HI7B6M-Ig

https://www.youtube.com/watch?v=p5S_v-_sFo4

Unit –III

Stability Analysis by Finite Element Approach:

Derivation of shape functions for atwonode Bernoulli-Euler beam element (lateral and translation DOF), element stiffness and element geometric stiffness matrices, assembled stiffness and geometric stiffness matrices for a discredited column with different boundary condition, elevation of critical loads for a discredited(two elements) column (both ends built-in),Algorithm to generate geometric stiffness matrix for four node Iso parametric elements, Buckling of pin jointed frames (maximum of two active DOF), symmetrical single bay portal frame.

Web Links:

https://www.youtube.com/watch?v=ZX55WyY43GU&list=PLrOpxdi4yBrFO-wajK1-9S5qK3dVKQ4hZ

https://www.youtube.com/watch?v=cHiFQ-cESkg

Unit –IV

Lateral Buckling of Beams:

Differential equation, pure bending, cantilever beam with point 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.

Web Links:

https://www.youtube.com/watch?v=dBP2VFHvun4

Unit – V

Buckling of Plates:

Expression for strain energy in plate bending (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 conditions along the other two sides.

Web Links:

https://www.youtube.com/watch?v=21G7LA2DcGQ&t=70s

https://www.youtube.com/watch?v=ApCtF13JaFw

Text Books:

1. Stephen. P. Timoshenko, James M. Gere, "Theory of elastic stability", 2nd edition, Mcgraw- Hill, New York
2. Bleich F, "Buckling Strength of Metal Structures", Mcgraw-Hill, New York

References:

1. Robert D Cook et-al, "Concepts and applications of finite element anlysis",4th edition, John Wiley and Sons, New York
2. S. Rajshekaran, "Computational structural mechanics", Prentice Hall,New Delhi

Course outcomes (COs):

The students will be able to

- Apply the knowledge of trigonometric series and Euler's formula for various loading and end conditions. (PO 3 & 4)
- Apply the elastic energy method in buckling of frames and continuous beams. (PO 3 & 4)
- Forecast safety against failure, through analytical modeling using software. (PO 3 & 4)
- Demonstrate structural stability of individual elements and also at junctions

bending elements. (PO 3 & 4)

- Buckling behavior of plates for various end conditions. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

STEEL - CONCRETE COMPOSITE STRUCTURES

Course Code: MSTE253 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

Introduction: Introduction to Steel - Concrete composite construction, Advantages, Theory of Composite structures, Introduction to steel- Concrete- Steel sandwich construction.

UNIT -II

Design of Composite Beams, Columns and Trusses: Behaviour of composite beams, Design of Composite beams, Behaviour of composite columns, Steel-Concrete composite columns, Design of composite trusses

UNIT -III

Design of Connections: Types of connections, Design of connections in composite structures, shear connections, Design of connections in composite trusses

UNIT -IV

Composite Box Girder Bridges: Introduction, Behavior of Box girder bridges, Design concepts

UNIT - V

Miscellaneous: Seismic behaviour of composite structures, Case studies on steel-Concrete composite construction in buildings.

Text Books:

1. Johnson R.P., "Composite structures of steel and concrete", Blackwell Scientific Publications, Second Edition, UK, 1994.
2. Owens G.W. and Knowels. P., "Steel Designers Manual", Fifth edition, Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.

References:

1. Proceedings of a workshop on "Steel Concrete Composite Structures", conducted at Anna University, 2000.
2. Steel Concrete Composite Construction, INSDAG Publication, Kolkata.

Course Outcomes (COs):

The students will be able to

- Acquire the knowledge of steel-concrete composites. (PO 3 & 4)
- Solve engineering problems with respect to design of composite beams, columns and trusses. (PO 3 & 4)
- Analyze structural system with the design concepts of composite structures. (PO 3 & 4)
- Design of box girder bridges. (PO 3 & 4)
- Understand the seismic behavior of composite structures. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment/PPT	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

DESIGN OF TALL STRUCTURES

Course Code: MSTE261 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

INTRODUCTION: History, Advantages & disadvantages, Economics, Essential amenities, Lifts (elevator), Fire safety, Water supply, Drainage and garbage disposal, Miscellaneous services, Structural and foundation systems, Design criteria, Design philosophy, loading, Sequential loading, Materials, High performance Concrete, Fibre reinforced Concrete, Light weight Concrete, Design Mixes.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://youtu.be/3PPDQ3L64do?si=aYDy5gixt1hEKiTT
- Links: https://archive.nptel.ac.in/courses/124/105/124105015

UNIT -II

LOADING AND MOVEMENT: Gravity loading: Dead and Live load, methods of live load reduction, Impact, gravity loading, construction load. Wind loading: Static and Dynamic approach, Analytical and wind tunnel experimental method. Earthquake loading: Equivalent lateral force, Modal analysis, combinations of loading, Working stress design, Limit state design, Plastic design.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://youtu.be/WkNz0mN08WY?si=zQKjqfgCPlmM1WPA
- Links: https://youtu.be/AxIx-2KCpcU?si=gSlKo2FOCiHfhBwn
- Links: https://archive.nptel.ac.in/courses/124/105/124105015

UNIT -III

BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS: Factors affecting growth, Height and Structural form-High rise behavior, Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubular, cores,outrigger-Braced and hybrid mega system.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://youtu.be/CuT7F_d05uw?si=tAq2nRXpxdCe-IDQ
- Links: https://youtu.be/U4VzWd-gOO8?si=BmUBtZzc7iMgXwaI
- Links: https://archive.nptel.ac.in/courses/124/105/124105015

UNIT -IV

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 analysis. Structural elements: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/124/105/124105015/
- Links: https://youtu.be/-qrDFxWflPg?si=AaECynq2qV8ttedi

UNIT - V

STABILITY OF TALL BUILDINGS: Overall buckling analysis of frames, wall-frames– Approximate methods, second order effects of gravity loading, P-Delta analysis, simultaneous first order and P-Delta analysis-Translational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/124/105/124105015/
- Links: https://youtu.be/zIWuyUyTsc8?si=hFM85CZQI0m-0B02

Text Books:

1. Taranath B.S., "Analysis & Design of Tall Building", McGraw-Hill Book Co, 1988.
2. Bryan S.S, and Alexcoull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc., 1991.

References:

1. Mark Fintel, "Hand book on Concrete Engineering", CBS Publishers, New Delhi.

Web links and Video Lectures (e-Resources):

4. https://youtu.be/3PPDQ3L64do?si=aYDy5gixt1hEKiTT
5. https://youtu.be/WkNz0mN08WY?si=zQKjqfgCPlmM1WPA
6. https://youtu.be/CuT7F_d05uw?si=tAq2nRXpxdCe-IDQ
7. https://archive.nptel.ac.in/courses/124/105/124105015

8. https://youtu.be/zIWuyUyTsc8?si=hFM85CZQI0m-0B02

Course Outcomes (COs):

At the end of the course, students will be able to

1. Evaluate essential amenities, structural systems, and design criteria for high-rise buildings. (PO1, PO3)
2. Analyze gravity, wind, and earthquake loads and apply appropriate design methodologies. (PO1, PO3)
3. Assess the behavior of different structural systems in high-rise buildings. (PO1, PO3)
4. Analyze and design structural elements for high-rise buildings. (PO1, PO3).
5. Conduct stability analysis for tall buildings, considering gravity loading and P-Delta effects. (PO1, PO3).

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

MASONRY STRUCTURES

Course Code: MSTE262 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT I

Introduction, Masonry Units, Materials & Types: History of masonry, characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units, strength, modulus of elasticity & water absorption, Masonry materials - Classification & properties of mortars, selection of mortars

- Pedagogy / Course delivery tools: Chalk and talk

Web Links:

https://youtu.be/kd5y-Cpy5oI?si=OWh3GllmFzDlyBYT

UNIT II

Strength of Masonry in Compression: Behavior of Masonry under compression, strength & elastic properties , influence of masonry unit & mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression. Effect of slenderness & eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

- Pedagogy / Course delivery tools: Chalk and talk

Web Links:

https://youtu.be/Z5z46jjKtqo?si=JIWwf2HMigV04RvY

UNIT III

Flexural & Shear Bond, Flexural Strength & Shear Strength: Bond between masonry unit & mortar , tests for determining flexural & shear bond strengths, factors affecting bond strength , effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure , shear strength of masonry, test procedures for evaluating flexural& shear strength, Permissible compressive stress, stress reduction & shape reduction factors, increase in Permissible stresses for eccentric vertical & lateral loads, permissible tensile & shear stresses.

- Pedagogy / Course delivery tools: Chalk and talk

Web Links:

https://youtu.be/0FLIhIMgEHg?si=GiQxdYSMCfwYqkA8

UNIT IV

Design of Load Bearing Masonry Buildings: Permissible compressive stress, stress reduction & shape reduction factors, increase in Permissible stresses for eccentric vertical & lateral loads, permissible tensile & shear stresses , Effective height of wall & columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action , lintels, Wall carrying axial loads, eccentric load with different eccentricity ratios, wall with openings, freestanding wall. Concept of Limit State Design of load bearing masonry for building up to 3 to 8 storey using Reinforced Masonry with Proposed BIS Course Code provisions.

- Pedagogy / Course delivery tools: Chalk and talk

Web Links:

https://youtu.be/aapJry0-Bnk?si=4d9yvPSY5aEtWTh7

UNIT V

Earthquake Resistant Masonry Buildings: Behavior of masonry and Reinforced Masonry during earthquakes, concepts & design procedure for earthquake resistant masonry, Masonry arches, domes & vaults Components & classification of masonry arches, domes & vaults, historical buildings, construction procedure

- Pedagogy / Course delivery tools: Chalk and talk

Web Links:

https://youtu.be/HJBzvcbnfiA?si=rx9R5e8KnlrKeF9_

Text Book

1. Hendry A.W , "Structural masonry" , Macmillan Education Ltd. ,2nd edition
2. Sinha B.P & Davis S.R. , "Design of Masonry structures" , E&FN Spon.

Reference Books

1. Dayaratnam P, "Brick & Reinforced Brick structures" , Oxford & IHB
2. Curtin, "Design of Reinforced & Pre stressed Masonry" , Thomas Telford
3. Sven Sahlin, "Structural Masonry" , Prentice Hall

4. Jagadish K.S Venkatarama Reddy B.V & Nanjunda Rao K.S , "Alternative building materials & technologies" , New age International , New Delhi & Bangalore
5. IS 1905 BIS New Delhi
6. SP 20 (S & T) New Delhi

Course Outcomes (Cos)

The students will be able to

- Classify and describe the characteristics of Brick, stone, clay block, concrete block, (PO 1, 3 & 4)
- Describe the behavior of masonry under compression, strength & elastic properties. (PO 3 & 4)
- Calculate masonry flexural, shear bond strength of and permissible compressive stress. (PO 3 & 4)
- Analyze and design the load bearing masonry building. (PO 3 & 4)
- Understand behavior of masonry building during lateral loads and design earthquake resistant masonry building. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

ANALYSIS AND DESIGN OF OFFSHORE STRUCTURES

Course Code: MSTE263 **Credit: 3:0:0**

Contact Hours: 42

Course Content

Unit- I

Wave Theories: Wave generation process, small and finite amplitude wave theories.

Unit -II

Forces of Offshore Structures: Wind forces, wave forces on vertical, inclined cylinders, structures- Current forces and use of Morison equation.

Unit- III

Offshore and Soil Structure Modeling: Different types of offshore structures, foundation modeling, structural modeling.

Unit -IV

Analysis of Offshore Structures: Static method of analysis, foundation analysis and dynamics of offshore structures.

Unit- V

Design of Offshore Structures: Design of Platforms, helipads, Jacket tower and mooring cables and pipelines.

Text Books:

1. Chakrabarti S.K., "Hydro dynamics of Offshore Structures", Computational Mechanics Publication, 1987.
2. Reddy D.V. and Arockiasamy M., "Offshore Structures", Vol.1 and Vol.2, Krieger Publising Company, Malabar, Florida, 1991.

References:

1. AP1, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex, 2000.
2. Wiegel R.L., "Oceanographical Engineering", Prentice Hall Inc, Engle wood Cliffs, N.J. 1964.
3. Brebia C.A. Walker S., "Dynamic Analysis of Offshore Structures", New-nes Butter worths, U.K.1979.

4. Thomas H. Dawson, “Offshore Structural Engineering”, Prentice Hall Inc Englewood Cliffs, N.J.1983.

Course outcomes

The students will be able to

- Acquire the basic knowledge in the area of wave analysis related to the design of offshore structures. (PO 3 & 4)
- Analyze the different forces of offshore structures. (PO 3 & 4)
- Acquire knowledge of different types of offshore structures and soil structure modeling. (PO 3 & 4)
- Perform static and dynamic analysis of offshore structures. (PO 3 & 4)
- Design the supporting systems to offshore structures. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

ADVANCED COMPUTATION LABORATORY

Course Code: MSTL27 **Credit: 0:0:1**
Course Coordinator: Dr B Suguna Rao **Total session: 14**

Course Content

1. Chi-square test of goodness of fit, Confidence interval. Curve fitting by the method of least squares, linear correlation & regression, multiple linear regression. Analysis of variance
   https://www.youtube.com/watch?v=hdKrUoeUQjE
   https://www.youtube.com/watch?v=JAJ-bIp5Mvw
   https://www.youtube.com/watch?v=Ddvqf22Cv6c
2. Analysis of steel trusses using STAAD-Pro., SAP
   https://www.youtube.com/watch?v=U1L_9VmbWjQ
   https://www.youtube.com/watch?v=8oHJ5TqtIUw
3. Static analysis of Building structure using software (ETABS / STAADPRO)
   https://www.youtube.com/watch?v=nuatOOtfQRo
   https://www.youtube.com/watch?v=mU0sWpSXWgo
4. Dynamic analysis of Building structure using software (ETABS / STAADPRO)
   https://www.youtube.com/watch?v=xdUZijJxhAg
   https://www.youtube.com/watch?v=MZm2Ek0vB3U
5. Design of RCC structure using software (ETABS / STAADPRO)
   https://www.youtube.com/watch?v=iVlCsJzH6Pc
   https://www.youtube.com/watch?v=lJXjsFP3oeQ
6. Design of Steel structure using software (ETABS / STAADPRO)
   https://www.youtube.com/watch?v=F0rNSk83RHk
   https://www.youtube.com/watch?v=pOQR5jsa0ko
7. Analysis and design of Elevated Water Tank using STAAD-Pro., SAP
   https://www.youtube.com/watch?v=abFpeQym9jo
   https://www.youtube.com/watch?v=OjuF1opuJFA
8. Analysis and design of bridge decks and other structures using STAAD-Pro., SAP
   https://www.youtube.com/watch?v=zwrVwSP3z1A
   https://www.youtube.com/watch?v=W_qs-eaKv1g
9. Stress analysis of cantilever beam, simply supported beam and fixed beam using ANSYS.
   https://www.youtube.com/watch?v=VJxxnmpVWac
   https://www.youtube.com/watch?v=CTi1ru-pfi0

10. Stress analysis of Plate with hole using ANSYS
    https://www.youtube.com/watch?v=jSxd_8HNLR4
    https://www.youtube.com/watch?v=unZTDl3Mumk

Text Books:

1. Sarma, T. S. (2014). Staad Pro v8i for beginners. India: Notion Press. Notion Press.
2. Step by Step Analysis and Design of High Rise Building Using ETABS: A complete Guide Paperback – February 27, 2020. by Mahesh Navnath Patil , Vinay Ashok Rangari, Dr. Shailendrakumar Dubey .

Reference Books:

1. Rajaraman, V. Computer Oriented Numerical Methods, Prentice – Hall of India, 2004
2. Finite Element Analysis: Theory and Application with ANSYS - (2008 3rd ed.) - Saeed Moaveni, Minnesota
3. State University, Mankato CSI Analysis Reference Manual - Etabs 2013
4. Analysis and Design of Structures – A Practical Guide to Modeling Book D. Trevor Jones

Course outcomes (COs):

Students will be able to

- Apply Statistical skills using soft computing tools to arrive at regression value and goodness to fit curve (PO1, 2, 3,4 and 5)
- Analyze the static and Dynamic behavior of RC Building (PO1, 2, 3,4 and 5)
- Design and develop analytical skills on Elevated Water Tank and Bridge deck (PO1, 2, 3,4 and 5)
- Optimize a structural system by evaluating to non-linear static analysis. (PO1, 2, 3,4 and 5)
- Explore the dynamic analysis capabilities of ANSYS. Modal, Harmonic, and Transient Analyses (PO1, 2, 3,4 and 5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	**Marks**	**Course Outcomes addressed**
Weekly evaluation of laboratory manuals/records after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation: 50		
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4 & CO5

DYNAMICS & EARTHQUAKE ENGINEERING LABORATORY

Course Code: MSTL28 **Credit: 0:0:1**

Course Coordinator: Dr. Basavanagowda G M **Total session: 14**

Course Content

List of Experiments

1. Determination of Natural frequency of Equivalent Spring Mass System
a. By studying the free longitudinal vibrations of a spring mass system
b. By verifying the Dunkerley's formula for transverse vibration.
c. Analysis of SDOF System using MATLAB Program.
2. Determination of Natural frequency of three storied building frame subjected to harmonic base motion.
3. Determination of Natural frequency of one-storied building frame with planar asymmetry subjected to harmonic base motions
4. Dynamics of a three storied building frame subjected to periodic (non-harmonic) base motions
5. Vibration isolation of a secondary system
6. Dynamics of a vibration absorber
7. Dynamics of a four storied building frame with and without an open ground floor
8. Dynamics of one-span and two-span beams
9. Earthquake induced waves in rectangular water tanks
10. Seismic wave amplification, liquefaction and soil-structure interactions.

Text Books:

1. Mario Paz,Structural Dynamics, CBS Publishers, New Delhi
2. Anil K Chopra, Dynamics of structures, Pearson Publications, New Delhi.
3. Steven L Kramer, Geotechnical Earthquake Engineering, Pearson Education.
4. James L Stratta, Manual for Seismic Design, Pearson Education, Asia, New Delhi.

Reference Books:

1. Clough and Penzein, Dynamic of structures, Mcgraw Hill Publishers, New York Manuals of Dynamics of structures.

Course outcomes (COs):

The students will be able to

- Evaluate the natural frequency of SDOF systems subjected to free longitudinal vibrations (PO1, 2, 3 and 5)
- Analyze the three storied building subjected to harmonic and non-harmonic base excitations (PO1, 2, 3 and 5).
- Assess the impact of vibration isolation on the seismic performance of structure (PO1, 2 and 3).

- Understand the concept of soft story and weak story and their performance during earthquakes (PO1, 2, 3 and 4).
- Recognize the necessity of soil structure interaction and effect of liquefaction during earthquakes (PO1, 2, 3 and 5)

Web Links:

1. https://www.youtube.com/shorts/GzRO7rUDiRE
2. https://www.youtube.com/watch?v=7hoSqazNmfY
3. https://www.youtube.com/watch?v=H4VQul_SmCg

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	**Marks**	**Course Outcomes addressed**
Weekly evaluation of laboratory manuals/records after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation: 50		
Semester End Examination (SEE)	**50**	CO1, CO2, CO3, CO4 & CO5

ADVANCED DESIGN OF STEEL STRUCTURES

Course Code: MSTE311 **Credit: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: General methods of plastic design, trial and error method, method of combining mechanism method, Estimation of deflection.

Web links:

www.youtube.com/watch?v=ioGGx9Zi7b8&list=PLjJwBYxz7Cym0EPBxaBxmXEicsFszHppF

Unit II

Plastic Analysis: Factors affecting the fully plastic moment, Plastic design of continuous beams, rectangular and gable frame, minimum weight design, Composite Beams

Web Links:

www.youtube.com/watch?v=p0eeq3Oj4&list=PL8GY2QIKoRvm5Ita5gmgxhw4tAT1h6vhe

Unit III

Industrial Building: Design of Industrial Buildings, Trussed bents, Rigid frames (including fixed column bases) Gantry Girders.

Web Links: www.youtube.com/watch?v=DeQICulUEEI

Unit IV

Light Gauge Sections: Analysis and Design of light gauge sections, Plate Girders

Web Links: www.youtube.com/watch?v=gQvcQrxGVr4

Unit V

Chimney: Design of chimney, bins and silos

Web Links: www.youtube.com/watch?v=DFRlNG1W9gI

Text Books:

1. Plastic analysis by B.G Neal
2. Design of steel structures by Arya and Ajmani

References:

1. Plastic analysis of steel structures by L.S.Beedle.

2. Design of Steel structures by Ramachandra Vol-II
3. Introduction to plastic analysis of steel structures by J.F Bakar and Heyman. Publication /Publishers.
4. Design of steel structures by Edwin A. Gaylord, Jr. Charles N.Gaylord, James E Stallmeyer.
5. Design of Steel structure by N.Subramanyam

Course Outcomes (COs):

The students will be able to

- Reproduce the basic knowledge of plastic design and estimation of deflection. (PO 3 & 4)
- Apply the knowledge of plastic analysis to various component of structural system. (PO 3 & 4)
- Design of Industrial Buildings. (PO 1, 2, 3 & 4)
- Analysis and Design of light gauge sections. (PO 1, 2, 3 & 4)
- Design of chimney, bins and silos. (PO 1, 2, 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment/PPT	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

PRE-FABRICATED STRUCTURES

Course Code: MSTE312 **Credit: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: Need for prefabrication, principles, materials, modular coordination, standardization, systems production, transportation and erection.

Unit II

Prefabricated Components: Behaviour of structural components, Large panel constructions, Construction of roof and floor slab, Wall panels, Columns, Shear walls.

Unit III

Design Principles: Disuniting of structures, Design of cross section based on efficiency of material used, Problems in design because of joint flexibility, Allowance for joint deformation.

Unit IV

Joint in Structural Members: Joints for different structural connections, Dimensions and detailing, Design of expansion joints.

Unit V

Design for Abnormal Loads: Progressive collapse, Code provisions, Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,Importance of avoidance of progressive collapse.

Text Books

1. CBRI, Building materials and components, India,1990
2. Gerostiza C.Z.,Hendrikson C. and Rehat D.R.,Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

References

1. Koncz T., Manual of precast concrete construction, Vols.I, II and III, Bauverlag, GMBH, 1971.
2. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 1978.

Course Outcomes (COs):

The students will be able to

- Understand the principles, need and the erection methods of prefabricated structures. (PO 3 & 4)
- Analyze the Prefabricated components for different types of loads. (PO 3 & 4)
- Design various cross sections of prefabricated structures. (PO 3 & 4)
- Analyze and detail the joints for different structural connections and expansion joints. (PO 3 & 4)
- Apply the codal provisions for designing the structures to abnormal loads. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment/PPT	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

COMPOSITE AND SMART MATERIALS

Course Code: MSTE313 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

Introduction to the Composite materials: classifications and applications. Anisotropic elasticity- unidirectional and anisotropic laminate, thermo-mechanical properties, micro-mechanical analysis, characterization tests. Classical composite lamination theory, cross and angle-play laminates, symmetric, anti-symmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories-first fly failure, vibration and buckling analysis. Sandwich structure face and core materials, secondary failure modes environmental effects, manufacturing of composites.

Web links:

https://www.youtube.com/watch?v=JBMVZpRD-Zk

https://www.youtube.com/watch?v=CMhwNTMe_mo

UNIT -II

Introduction to smart materials and structures-piezo electric materials-coupled elctro mechanical constitutive relations-depoling and coercive field-field-strain relation-hysterics-creep-strain rate effects-manufacturing.

Web links:

https://youtu.be/VCTbRjMsc_c

https://youtu.be/vZCI_9NPIyo

UNIT -III

Actuators and sensors-single and dual actuators-pure extension, pure bending-bending extension relations-uniform strain beam model-symmetric induced strain actuators-bond shearing force- Bernoulli's-Euler (BE) beam models-embedded actuators-Asymmetric induced strain actuators in uniform strain and Euler-Bernoulli models. Uniform strain model–energy principle formulation-BE model- single and dual surface bonded actuators-Extension-bending and torsion model.

Web links:

https://www.youtube.com/watch?v=nE1C4ghfvac

https://youtu.be/kvNQsuwg_hQ

UNIT -IV

Introductions to control systems-open loop and close loop transfer functions-stability criteria- deflection control of beams like structures-using piezo electric sensors and actuators-shape memory alloy.

Web links:

https://youtu.be/yf09OrHa520
https://youtu.be/_KdWxyWHsqk

UNIT - V

Introduction to Nano structured materials, chemical and structural characterization, material behavior and technological implications to these materials.

Web links:

https://youtu.be/ATYHwqJXD-M

Text Books:

1. Robert M Jones, "Mechanic of Composite Materials", McGraw Hill Publishing Co.
2. Bhagwan D, Agaravalam &Lawrence JBrutman, "Analysis and Performance of Fiber Composites", John Wiley and Sons.

Reference Books:

1. Lecture notes on, "Smart Structures", by Inderjith Chopra, Department of Aerospace Engg. University of Maryland
2. Crawley E &Anderson E, "Detailed Models of Piezo cermic actuation of Beams", proceedings of the 30th AIAA/ASME/ASME/ASCE/AHS/ASC-Structural dynamics and Material conference, AIAA Washington DC, April 1989.
3. Crawley E & DeLuisJ, "Use of Piezoelectric actuators as elements of Intelligent Structures", AIAA Journal, Vol. 25, No 10, Oct 1987, pp 1373-1385.

Course Outcomes (COs):

The students will be able to

- Classify Composite materials and its applications. (PO1, PO3, PO4, PO5)
- Understand the application of smart materials in structural elements. (PO1, PO3, PO4, PO5)
- Understand the behaviour of Actuators and sensors. (PO1, PO3, PO4, PO5)

- Apply the knowledge of control systems in structural elements. (PO1, PO3, PO4, PO5)
- Understand the Structural characterization of nano material (PO1, PO3, PO4, PO5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

Course Code: MSTE321 **Credit: 3:0:0**
Course coordinator: Dr. Basavanagowda G M **Contact Hours: 42**

Course Content

UNIT I

Engineering Seismology:
Elastic rebound theory and Theory of plate tectonics, Seismic waves, Seismic zoning, Seismic risk and hazards, Magnitude and intensity, Seismic pickups, Strong ground motion, Local site effects, Response of structures, Return period of an event.

Pedagogy/Course delivery tools: Through MOOC/NPTEL Videos
Links: https://archive.nptel.ac.in/courses/105/101/105101004/
https://archive.nptel.ac.in/courses/105/102/105102016/

UNIT II

Response Spectra: Elastic and inelastic design spectra, Tripartite plot, Use of response spectrum in earthquake resistant design, Selection of design EQs, Peak ground acceleration, Comparison of design and response spectra, Effects of yielding and ductility, Response control concepts using external devices and energy dissipating devices. Field Response spectra (basics).

Pedagogy/Course delivery tools: Through MOOC/NPTEL Videos
Links: https://archive.nptel.ac.in/courses/105/101/105101004/
Concept of Response spectra:http://surl.li/ufrha

UNIT III

Conceptual Design: Structural configuration for earthquake resistant design, Simplicity and symmetry, frames, Shear walls and dual systems, Effect of infill masonry on frames, soft and weak storeys, Ductility and energy absorption in buildings, Strong column - weak beam design, Base isolation, Construction materials

Pedagogy/Course delivery tools: Through MOOC/NPTEL Videos
Links: https://archive.nptel.ac.in/courses/105/101/105101004/

UNIT IV

Earthquake Analysis: Seismic design requirements, Design Earthquake loads, Load combinations, Mathematical modelling, Methods of analysis - Seismic coefficient method, Response spectrum method and Time history method, Symmetrical and unsymmetrical structures, Torsion in structures, Structural requirements, Earthquake resistant design methods.

Pedagogy/Course delivery tools: Through MOOC/NPTEL Videos
Links: https://archive.nptel.ac.in/courses/105/101/105101004/
https://archive.nptel.ac.in/courses/105/102/105102016/

UNIT V

Reinforced Concrete, Steel and Masonry Structures: Damages during past earthquakes, Ductility and Course Code guidelines, Capacity based designs, Design of shear walls, Precast constructions, Behaviour of steel, Ductility requirements, Flexural members, Stiffeners and bracings, Retrofitting. Basic earthquake resistant design features and considerations for masonry structures.

Pedagogy/Course delivery tools: Through MOOC/NPTEL Videos
Links: https://archive.nptel.ac.in/courses/105/106/105106216/
Capacity based design: https://www.youtube.com/watch?v=fL06uRR7MnU
Ductile detailing: https://www.youtube.com/watch?v=fWMUwh90dMI

Text Books:

1. Pankaj Agarwal and Manish Shrikande, Earthquake Resistant Design of Structures, Prentice Hall of India Private Ltd, New Delhi, 2011.
2. Duggal S K, Earthquake Resistant Design of Structures, Oxford University Press, New Delhi, 2013.
3. Dr. Vinod Hosur, Earthquake Resistant design of building structures, Wiley Publications.

Reference Books:

1. James L Stratta, Manual of Seismic Design, Pearson Education, Asia, New Delhi, 1987.
2. Anil K Chopra, Dynamics of Structures, Pearson Education, Asia, New Delhi, 2007.
3. Steven L Kramer, Geotechnical Earthquake Engineering, Pearson Education, Asia, New Delhi, 1995.
4. **IS Codes:** IS 1893: 2016, IS 13920: 2016, IS 4326: 2013, IS456(2000), SP16

Course Outcomes (COs):

Students will be able to

- Identify the theories responsible for occurrence of earthquakes, consequences and necessity of seismic zoning (PO1, 2 & 3)
- Construct the site specific response spectra for a particular earthquake and response control using energy dissipating devices (PO1, 2 & 3).
- Recognize the necessity of conceptual design, ductility and base isolation of structural systems to minimize the damage to structures (PO1, 2 & 3).
- Evaluate the forces in the structures subjected to earthquake loading adopting codal provisions (PO1, 3 &4).
- Design the shear walls, ductility design of beams and columns, ductile detailing of Beam Column Connections (PO1, 3, 4 &5).

Web Links:

1. Course material on Earthquake Behaviour of Buildings: EBB_001_30May2013 PDF (www.iitk.ac.in)
2. Explanatory Examples on Indian Seismic Code IS 1893- https://www.iitk.ac.in › nicee › IITK-GSDMA.
3. https://www.youtube.com/watch?v=fL06uRR7MnU
4. https://www.youtube.com/watch?v=fWMUwh90dMI

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	**Marks**	**Course outcomes mapped**
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project Work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

AI APPLICATIONS IN CIVIL ENGINEERING

Course Code: MSTE322 **Credit: 3:0:0**

Contact Hours: 42

Course Content

UNIT - I

Introduction: Introduction to AI, definition of AI, Historical evolution of AI, AI types, brief introduction to the branches of AI, Machine learning, Natural Language processing, computer vision, robotics, expert systems, Artificial neural networks and deep learning, evolutionary computation, cognitive computing, and swarm intelligence. Applications in civil engineering in each branch of AI.

UNIT -II

Machine Learning: Introduction to ML, Machine learning process model, Concept learning, general-to- specific ordering, version spaces, inductive bias, general to specific ordering, introduction to different kinds of machine learning, supervised, unsupervised, semi supervised, reinforcement, transfer learning and federated learning. The related algorithms 14 under each type of ML, Applications of different ML techniques in Civil Engineering. Well posed learning problem, designing a learning system, examples.

UNIT -III

Artificial neural networks (ANN): Introduction, biological motivation, appropriate problems in ANN learning, perceptron's- the representational power of perceptions, multilayer networks, back propagation. Introduction to recurrent neural networks, and deep learning. Illustrative real-world examples on applications of neural networks in highway/ infrastructure construction management and other civil engineering domains.

UNIT -IV

Fuzzy Logic: Learning under uncertainty and ambiguity, fuzzy logic, linguistic variables, fuzzy sets, membership functions, fuzzy set operations, fuzzy expert systems, fuzzification, defuzzification, fuzzy rules, fuzzy inferences. Fuzzy inference system, Illustrative examples of engineering applications of fuzzy logic with specific reference to civil engineering.

UNIT - V

Introduction to Computer Vision: Definition and scope, history and evolution, Image acquis ion, image representation (grey scale and color), basic operations like filtering, thresholding. Primitives of image processing, geometric primitives, 2d Transforms, 3D

transforms, photometric image formation, lighting, reflectance and shading, the digital camera, sampling and aliasing. Applications of computer vision in Civil engineering.

Text Books:

1. Margaret A Boden, Artificial Intelligence, Academic Press London, 1996.
2. Stuart Russel, Peter Norvig, Artificial Intelligence- A modern approach, II Edition, Pearson Education, 2003.

References:

1. Kothari DwarkadasPralhaddas, SamuiPijush, Artificial Intelligence in Civil Engineering, Lambert Academic Publishing, 2012.
2. Nikos D. Lagaros and VagelisPlevris, Artificial Intelligence Applied in Civil Engineering, MDPI, 2022.
3. Paul D.Harrison, Artificial Intelligence Applications in Material Science and Engineering, Kindle Edition, 2023

Course Outcomes (COs):

The students will be able to

- Gain insights into the role of AI in modern civil engineering practices and how it can enhance decision-making and efficiency. (PO 3 & 4)
- Use the Acquired knowledge of basic Machine Learning algorithms and techniques and develop the ability to implement and evaluate ML models for solving complex civil engineering problems. (PO 3 & 4)
- Comprehend the structure and functioning of Artificial Neural Networks, including various architectures and learning algorithms, and apply ANN techniques to model and solve real-world civil engineering problems. (PO 3 & 4)
- Apply the principles of Fuzzy Logic and apply the same in handling uncertainty and imprecision in Civil engineering problems. (PO 3 & 4)
- Implement computer vision and image processing techniques, and be able to implement computer vision methods for automated inspection, monitoring, and assessment of civil infrastructure. (PO 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment/PPT	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

DESIGN OF SUBSTRUCTURES

Course Code: MSTE323 **Credit: 3:0:0**
Course coordinator: Dr. J Sumalatha **Contact Hours: 42**

Course Content

Unit I

Classification of foundation systems: General requirement of foundations, Selection of foundations, Computations of Loads, Design concepts. Shallow Foundations: Bearing capacity failures, Bearing capacity formulae & factors, Factor of safety, Selection of soil shear strength parameters, Settlement analysis of footings, Structural Design of Shallow foundations in different soils, Footings on layered soils and sloping ground, foundations on rocks, Structural Design of foundations for Eccentric or Moment Loads.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=s6E2t_kW57M
- Links: https://www.youtube.com/watch?v=UtwSIgWQlUM

Unit II

Combined footings: Rectangular & Trapezoidal Footings, Strap footings, structural design of Combined Footings, Types of rafts, bearing capacity & settlements of raft foundations, Rigid methods, Elastic theory in raft foundations.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=BAuxl66VEc0
- Links: https://www.youtube.com/watch?v=rYDTYsuCdzc

Unit III

Deep foundations - Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, laterally loaded piles, tension piles & batter piles, Load testing of piles, Structural design of Pile foundations.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=6mAaqD7BdmI
- Links: https://www.youtube.com/watch?v=jR2cBYvXTzg

Unit IV

Pile groups: Bearing capacity and settlement of pile groups in different soils, uplift capacity of pile groups, load distribution between piles, Proportioning and design concepts of pile cap, Structural design of Pile Cap.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=bIPr5rG2Bjo
- Links: https://www.youtube.com/watch?v=XM6zojEotDw

Unit V

Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability and design considerations, Structural design of tower foundations, Retaining walls - analysis and design. Foundations on problematic soils – collapsible soils, expansive soils, and sanitary landfills.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint presentations, Videos
- Links: https://www.youtube.com/watch?v=q8kFYPCG8zo
- Links: https://www.youtube.com/watch?v=fFWqlwuz_0s

Text Books:

1. Swami Saran – "Analysis & Design of Substructures", Oxford &IBH Pub. Co. Pvt. Ltd., 1998.
2. Nainan P Kurian – "Design of Foundation Systems", Narosa Publishing House, 1992

References:

1. R.B. Peck, W.E. Hanson &T.H. Thornburn – "Foundation Engineering", Wiley Eastern Ltd., Second Edition, 1984.
2. Joseph E. Bowles – "Foundation Analysis and Design", McGraw-Hill Int. Editions, Fifth Ed., 1996.
3. W.C. Teng – "Foundation Design", Prentice Hall of India Pvt. Ltd., 1983.
4. Bureau of Indian Standards Course Codes: IS-1498, IS-1892, IS-1904, IS-6403, IS-8009, IS-2950, IS-11089, IS-11233, IS-2911, IS - 802 and all other relevant Course Codes.

Web Links:

https://www.youtube.com/watch?v=B8pivQRbPj8

https://www.youtube.com/watch?v=CCkznoKjfSM&t=16s

https://www.youtube.com/watch?v=dwVnVEnpTRU

https://www.youtube.com/watch?v=p3tzvx9-E_I

https://www.youtube.com/watch?v=UummY_mo85Y

Course Outcomes (COs):

Students will be able to

- Analyze the Geotechnical data for the estimation of bearing capacity and settlement of soil under different field conditions. (POs 1, 2, 3 & 4)
- Design different types of shallow foundations and perform settlement analysis. (POs 1, 2, 3 & 4)
- Design deep foundations in different soil conditions. (POs 1, 2, 3 & 4)
- Design pile groups through bearing capacity and settlement analysis of soil. (POs 1, 2, 3 & 4)
- Analyze and / or design special foundations like tower structures, retaining walls and foundations on problematic soils. (POs 1, 2, 3 & 4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	**Marks**	**Course outcomes mapped**
Internal test-I	30	CO1 & CO2
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Assignment	10	CO1 & CO2
Assignment/Mini project Work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

INTERNSHIP / INDUSTRIALTRAINING

Course Code: MSTI33 **Credit: 0:0:5**

Course Content

Course outcomes (COs):

The students will be able to

- Analyse, design and investigate an engineering problem using an appropriate problem-solving methodology and to implement it for a sustainable solution. (POs 1, 2, 3, 4 & 5)
- Apply the acquired knowledge, skill, and professional attitude to solve a professional engineering problem. (POs 1, 2, 3, 4 & 5)
- Acquire managerial skills to complete the project within the given time frame and to conclude on the findings. (POs 1, 2, 3, 4 & 5)
- Acquire knowledge on client handling and corporate working style. (POs 1, 2, 3, 4 & 5)
- To compile the results of the findings and to develop a professional report. (POs 1, 2, 3, 4 & 5)

PROJECT WORK - I

Course Code: MSTP34 **Credit: 0:0:6**

Contact Hours: 6/week

Course Content

- The project review committee conducts the review at the end of the third semester for 100 marks.

Course outcomes (COs):

The students will be able to

- Select a relevant research topic and conduct comprehensive literature Survey (PO1, PO2).
- Formulate a clear research problem & set specific objectives for experimental and analytical work (PO1, PO2).
- Develop a detailed methodology outlining experimental and Analytical approaches (PO2, PO4).
- Conduct initial data collection and analysis to refine objectives and methodology (PO1, PO3)
- Conduct feasibility studies to assess the practicality and scope of the proposed experiment and analytical approaches (PO1, PO5)

PROJECT WORK - II

Course Code: MSTP41 **Credit: 0:0:18**

Contact Hours:18/week

Course Content

The review, conduct in the fourth semester, includes both CIE and SEE. The CIE evaluation for Phases I, II, and III is 50 marks and the SEE is 300 marks.

Continuous Internal Evaluation (CIE)

The Continuous Internal Evaluation (CIE) is conducted by the project review committee per rubrics for Phases I, II, and III. Each committee member evaluates the project separately, and the scores are averaged. Phase I is 10 marks, Phase II is 40 marks, and Phase III is 60 marks, Total 100 marks scaled down to 50 marks.

Semester End Evaluation (SEE)

The SEE evaluation consists of 300 marks: 100 marks each from the project report evaluations by the guide and an external examiner, and 100 marks from the final viva voce assessed jointly by both.

Course outcomes (COs):

The students will be able to

- Review and refine research objective and methodology based on feedback and initial findings (PO1, PO2).
- Design and implement the experimental setup and analytical model, conduct test and gather Data (PO1, PO2, PO4).
- Analyze experimental result and perform detailed analysis (PO1, PO3, PO4, PO5)
- Draw conclusions from research finding and identify potential are for further work (PO1, PO2, PO3).
- Communicate the findings of work to comprehensive report and to communicate in professional platform. (PO2, PO3).