Rashtreeya Sikshana Samithi Trust

R.V. College of Engineering

(Autonomous Institution Affiliated to VTU, Belagavi)

Department of Civil Engineering

Master of Technology (M. Tech.)

STRUCTURAL ENGINEERING

Scheme and Syllabus of
Autonomous System w.e.f 2016

R.V. College of Engineering, Bengaluru – 59
(Autonomous Institution Affiliated to VTU, Belagavi)
M. Tech. Structural Engineering
Department of Civil Engineering

Vision: Excel in Education, Research and Consultancy in Civil Engineering with emphasis on sustainable Development

Mission:

1. Disseminating and integrating the knowledge of structural, transportation, environmental and geotechnical engineering
2. Enhancing Industry – Institute interaction leading to Interdisciplinary research
3. Imbibing wide range of skills in cutting edge technology for sustainable development
4. Motivate entrepreneurship and professional ethics to serve the society

Program: STRUCTURAL ENGINERING

Program Educational Objectives (PEO)

After successful completion of structural engineering program, the post graduates will be able to

1. Independently analyze and design various forms of structures with sustainable materials.
2. Develop professionalism in academics, structural consultancy and entrepreneurship.
3. Pursue advanced research, career and participate in professional societies.
4. Address societal needs through interdisciplinary approach.

Program Outcomes (PO)

M. Tech. in Structural engineering graduates will be able to:

PO1: Scholarship of Knowledge – Acquire in depth knowledge of Structural Engineering, including wider and global perspective, with an ability to distinguish, evaluate, analyze and synthesize existing and new knowledge and integration of same for enhancement of knowledge.

PO 2: Critical Thinking – Analyze complex structural engineering problems critically, apply independent judgement for synthesizing information to make intellectual and creative advances for conducting research in the areas of wider theoretical, practical and policy context.

PO3: Problem Solving – Think laterally and originally, conceptualize and solve structural engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of structural engineering.

PO4: Research Skill – Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually / in groups to the development of scientific / technological knowledge in domains of structural engineering such as alternate construction materials, techniques and structural masonry.

PO5: Usage of Modern tool – Create, select, learn and apply appropriate computational tools, techniques, resources, modern engineering and structural analysis and design software for prediction and modeling of complex engineering activities with an understanding of their limitations.

PO6: Collaborative and multidisciplinary research – Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative multi-disciplinary scientific research, demonstrate capacity for self-management and team work, decision making based on open mindedness, objectivity and rational analysis in order to achieve common goals and further learning of themselves as well as others.

PO7: Project management and Finance- Demonstrate knowledge and understanding of engineering and project management principles and apply the same to one's own work as a member and leader in team, manage projects efficiently in structural engineering and multi-disciplinary environments after consideration of economic and financial factors.

PO8: Communication – Communicate with the engineering community and with society at large, regarding complex structural engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate codal provisions, make effective presentations and give and receive clear instructions.

PO9: Life Long Learning – Recognize the need for, and have the preparation and ability to engage in lifelong learning independently, with high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10: Ethical Practices and Social responsibility – Acquire intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the society for sustainable development.

PO11 Independent and reflective thinking – Observe and examine critically, outcome of one's actions and make corrective measures subsequently and learn from mistakes without depending on external feedback.

Program Specific Criteria (PSC)

Lead Society: American Society of Civil Engineers

1. Curriculum

The program prepares students for professional, teaching and research careers. Emphasis is on the acquisition of knowledge concerning to analysis, design, construction, maintenance, management and performance of structural components and structures with due consideration to public governing policies and guidelines.

2. Faculty competency

Faculties are qualified with post graduate and doctoral degrees in the stream of structural engineering. The faculties are actively publishing research papers in peer reviewed national and international journals related to structural engineering and allied fields leading to sustainable development. The faculties are also actively involved in R&D activities, patenting and associated with professional bodies.

Program Specific Outcomes (PSO)

M. Tech. in Structural engineering graduates will be able to:

PSO 1. Apply knowledge of materials and analysis for design of RCC, steel and masonry structures.

PSO 2. Demonstrate the use of alternate engineering materials, technologies and management for sustainable environment.

R. V. College of Engineering, Bengaluru – 59.

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Department of Civil Engineering

M. Tech. Structural Engineering

THIRD SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Experiential Learning S**	
1	16 MST 31	Special Construction Materials And Concrete	CV	4	0	1	0	5
2	16 MST 32X	Elective -5	CV	4	0	0	0	4
3	16 MST 33X	Elective -6	CV	4	0	0	0	4
4	16 MST34X/ 16MHT34X	Elective -7	CV	4	0	0	0	4
5	16MST35	Internship/ Industrial Training	CV	0	0	3	0	3
6	16MST36	Technical Seminar	CV	0	0	2	0	2
		Total		**16**	**0**	**6**	**0**	**22**

Elective 5			
16MST321	Earthquake Resistant Structures	16MST322	Precast Concrete Structures
Elective 6			
16MST331	Stability of Structures	16MST332	Advanced Structural Analysis
Elective 7			
16MHT341/ 16MST341	Design of Bridges, flyovers and grade separators	16MHT342/ 16MST342	Earth Retaining structures

FOURTH SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Experiential Learning S**	
1	16MST41	Major Project	CV	0	0	26	0	26
2	16MST42	Seminar	CV	0	0	2	0	2
		Total		**0**	**0**	**28**	**0**	**28**

Credit Distribution

Category	Min	Max	Reco	RVCE
Core (incl. soft core)	15	25	20	32
Elective	25	35	30	28
Project Work	30	45	40	32
Internship/industrial -Field work	3	5	5	3
Seminar	3	5	5	5
TOTAL			**100**	**100**

SPECIAL CONSTRUCTION MATERIALS AND CONCRETE						
Course Code	**:**	**16 MST 31**		**CIE Marks**	**:**	**150**
Hrs/Week	**:**	**L: T: P: S**	**3:1:2:0**	**SEE Marks**	**:**	**150**
Credits	**:**	**5**		**SEE Duration**	**:**	**3 +3 Hours**

Course Learning Objectives: Students are able to

1	Understand various modern construction materials and methods
2	Apply the knowledge of different materials to modify the properties
3	Select appropriate materials for particular application
4	Proportion and estimate materials for different mixes

UNIT – I **8 Hours**

Review of conventional concrete. Non-destructive methods of testing – Rebound hammer test, Pulse velocity method, Pullout test, Electrical methods, Penetration resistance techniques.
Importance of steel reinforcement in RCC, Types, testing methods.

UNIT – II **7 Hours**

Geopolymers – Paste, mortar, concrete and masonry units. Concept, advantages, Proportioning, Geopolymer masonry, Applications. Ready Mixed Concrete, Advantages, Components of RMC Plant, Quality aspects of RMC.

UNIT – III **7 Hours**

Fibre reinforced concrete, Behaviour in compression and flexure. Types of fibres, Action of fibres, Failure of fibres, Simple Design and Application.
Light weight concrete, types, Materials used, Design of light weight concrete, Properties and Applications.

Unit – IV **7 Hours**

Ferro cement- Concept, materials, construction methods, Behaviour in tension, Simple design, Applications.
High Density concrete- Necessity, Radiation shielding, materials, methods of placement.

UNIT-V **7 Hours**

Nanotechnology and Concrete – Nono-Engineering, Manipulation of materials at nano scale, hydrate-hybridization, nano materials in concrete – Nano SiO_2, NanoTiO_2, Nano Al_2O_3, Nano clay, Carbon nano tubes, nanofibres, Properties and applications.

UNIT-VI (Lab Component)

1) Proportion concrete mix using BIS and ACI method and compare the properties.
2) Testing of concrete by Schimdt's hammer.
3) Testing of concrete by Pulse velocity method.
4) Location of rebars using profometer
5) Modulus of elasticity of concrete cylinder
6) Flexural strength of concrete.
7) Deflection of RCC beam
8) Preparation of alkaline solution and Casting of geopolymer concrete/Masonry block

Course Outcomes:

After going through this course the student will be able to

CO1: Explain the properties of modern construction materials.
CO2: Illustrate the use of construction materials
CO3: Identity suitable materials for specific application.
CO4: Design mixes for structural components.

Reference Books:	
1	P. Kumar Mehta, Paulo J. M. Monteiro, Concrete Microstructure, properties and Materials, McGraw Hill Education India Private Limited, New Delhi, Fourth Edition, 2015. ISBN-13: 978-93-393-0476-1.
2	A R Santhakumar, Concrete Technology ,Oxford University Press, 2012,ISBN-13:978-0-19-567153-7.
3	Neville. A.M, Properties of concrete IV Edition, Pearson Education, Inc, and Dorling Kindersley Publishing Inc. 1995.
4	Shetty. M.S., Concrete Technology Theory and Practice, S.Chand & Co Ltd., New Delhi, 2007.
Code Books:	
1	IS 10262 : 2009, Concrete Mix proportioning guidelines, First Revision.2009. ACI Committee 211, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete, ACI 211.1-91, American Concrete Institute, Farmington Hills, Michigan, 1991

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE) for Practical

SEE for the practical courses will be based on conducting the experiments and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	1	-	-	-	-	1	-	-
CO2	1	1	-	1	-	2	-	-	-	-	-
CO3	1	1	-	1	-	1	-	-	3	-	-
CO4	1	3	1	-	-	-	-	2	-	2	-

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	2	3
CO2	3	3
CO3	2	2
CO4	3	1

EARTHQUAKE RESISTANT STRUCTURES (Elective 5)						
Course Code	**:**	**16MST321**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S :: 4:0:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**04**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

1	Discuss the concepts in Engineering Seismology, response spectrum, structural configuration, ductility and seismic analysis
2	Classify lateral load resisting structural systems.
3	Assess and develop earthquake resistant structures.
4	Test the structural response of building under seismic loads

UNIT – I	**09Hrs**

Introduction to engineering seismology: Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems

UNIT – II	**10Hrs**

The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multistoreyed buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893

UNIT – III	**10Hrs**

Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behavior of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – Codal provisions

UNIT – IV	**10Hrs**

Design of Reinforced concrete buildings for earthquake resistance-Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS-1893. Structural behavior, design and ductile detailing of shear walls.

UNIT – V	**09Hrs**

Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures

Expected Course Outcomes:
After successful completion of this course the student will be able to:

1	Explain the concepts in Engineering Seismology, response spectrum, structural configuration, ductility and seismic analysis
2	Apply and illustrate lateral load resisting structural systems using codal provisions and seismic response control concepts.
3	Formulate and design earthquake resistant structures.

4	Evaluate the structural response of building under seismic loads

Reference Books:

1	Dynamics of Structures – Theory and Application to Earthquake Engineering- 2nd ed. – Anil K. Chopra, Pearson Education, 2011, ISBN-10: 0132858037; ISBN-13: 978-0132858038
2	Earthquake Resistant Design of Building Structures, Vinod Hosur, WILEY (India), 2013, ISBN 13, : 9788126538591
3	Earthquake resistant design of structures – Pankaj Agarwal, Manish Shrikande - PHI India, 2006, ISBN 10: 8120328922
4	IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993
5	Seismic Design of Reinforced Concrete and Masonry Buildings, T Paulay and M J N Priestley, John Wiley and Sons, 1992, ISBN 0-471-54915-0

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with Pos

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	-	-	-	-	-	-	-	-
CO2	H	H	M	-	L	-	-	L	-	-	-
CO3	H	H	-	-	-	-	-	-	H	-	-
CO4	H	H	M	H	-	-	-	L	H	-	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	M	-
CO2	M	-
CO3	H	-
CO4	H	-

PRECAST CONCRETE STRUCTURES(Elective 5)						
Course Code	**:**	**16MST322**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S:: 4:0:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**04**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

1	Ability to understand precast technologies.
2	Ability to understand the manufacturing process and its transportation.
3	Ability to design precast concrete elements.

UNIT – I	**09Hrs**
Concept of precast, precast products, standardization, precast accessories, types of precast constructions, methodologies, equipments and machineries, economy in comparison with cast in situ.	
UNIT – II	**10Hrs**
Precast and pre-stress plant setup production and storage systems, batching plant setup, logistic or transportation system.	
UNIT – III	**10Hrs**
Types of pre-stress hollow core slabs, manufacturing methodology, load chart and curves, preparation of layout cutting list, loading sequence, production loading transportation and erection, services and maintenance.	
UNIT – IV	**10Hrs**
Pre stress beams, TT slabs, manufacturing methods, production, loading transportation and erection applications.	
UNIT – V	**09Hrs**
Modular construction, types of precast elements, typical layout, joint details, shop drawings, design of precast columns, beams, panel, stairs and slab, mould fabrication, reinforcement details, casting, curing, stockyard and loading, transportation, site preparation and erection, finishing and handling over service and maintenance.	

Expected Course Outcomes(CO):

After successful completion of this course the student will be able to:

1. Demonstrate the precast concrete concepts, types of precast construction and its advantages.
2. Identify precast plant set up for production and storage systems, plan logistics of precast elements.
3. Examine different types of pre-cast elements.
4. Design of precast elements, manufacturing methods.

Reference Books:

1	Kim.S.Elliott,Precast Concrete Structures, Butterworth-Heinemann, An imprint of Elsevier Science,2002.
2	Hubert Bachmann and Alfred Steinle' Precast concrete structures' First edition,2011, Ernst &Sohn, GmbH &Co., ISBN978-3-433-60096-2.
3	Kim.S.Elliot and Colin K Jolly,'Multi –Storey Precast Concrete Framed Structures', 2nd Edition November 2013, Wiley-Blackwell , ISBN: 978-1-4051-0614-6
4	Prestressed Concrete Institute ,PCI Journal– Proposed Design Requirements for Precast

	Concrete, PCI Committee on Building Code and PCI Technical Activities Committee

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with Pos

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	-	L	H	-	-	L	-	H	-	L
CO2	H	M	-	H	-	-	M	-	M	H	L
CO3	H	-	M	-	-	-	-	-	H	L	L
CO4	H	H	M	M	-	-	-	-	H	H	L

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	-	L
CO2	-	M
CO3	-	H
CO4	H	-

STABILITY OF STRUCTURES (Elective 6)						
Course Code	**:**	**16CSE331**		**CIE Marks**	**:**	100
Hrs/Week	**:**	**L:T:P:S::4:0:0:0**		**SEE Marks**	**:**	100
Credits	**:**	**04**		**SEE Duration**	**:**	**3Hrs**

Course Learning Objectives (CLO): Graduates shall be able to

1	Learn principles of stability of structures
2	Study the concept of buckling
3	Analyse the structural elements for stability.
4	Evaluate the use of strain energy in plate bending and stability.

UNIT – I **9Hrs**

Buckling of columns: Eulers equation for buckling of elastic column, Buckling of columns with various boundary conditions, Deflection shapes of buckled columns. Energy method, Concepts of stable and unstable equilibrium of systems. Simple column model with a lateral spring, Approximate calculation of critical loads by energy method.

UNIT – II **10Hrs**

Inelastic Buckling: Effect of shear force on the critical load of column. Application to buckling of built up columns, Inelastic buckling. Limitations of Euler's theory, Reduced modulus theory and shenley's tangent modulus theory, comparison with experimental results.

UNIT – III **10Hrs**

Buckling of Eccentrically loaded columns: Effect of initial imperfections, perry Robertson approach to column failure. Influence of eccentricity and secant formula. Multiple column formulas. Multiple column curves of IS code for various imperfection factors. Selection of sections for compression members.

UNIT – IV **9Hrs**

Lateral buckling of beams: Lateral buckling of beams in pure bending, Lateral buckling of cantilever beam and narrow rectangular beams. Pure Torsion of thin – walled bars of open cross section. Non – uniform Torsion of thin – walled bars of open cross section

UNIT – V **10Hrs**

Buckling of thin Plates: Simply supported rectangular plate with uniform compression in one direction. Buckling of rectangular plates under the action of shearing stresses. Practical implication in the design of compression members and beams

Expected Course Outcomes:

1. Explain the principles of strength, stability and phenomenon of buckling
2. Apply the principles of stability to calculate buckling load.
3. Calculate the buckling load on column, beam – column, frames and plates using classical and approximate methods.
4. Develop analytical skills.

Reference Books:

1.	Stephen P.Timoshenko, James M Gere, "Theory of Elastic Stability"-2nd Edition, Tata McGraw Hill, New Delhi,2010, ISBN-10 0-07-070241-1 ISBN-13 978-0-07-070241-7
2.	F.Bleich Buckling strength of Metal structures, Tata McGraw Hill,1952

3.	N.Subramanian, Design of steel structures, Oxford University Press,2011, ISBN: 9780198068815.
4.	T.V.Galambos, Guide to stability design criteria for metal structures,5th Edition, John Wiley&Sons,Newyork,1998. ISBN 1-4196-5207-9.
5.	F.R.Shanley,Strength of Materials,Tata McGraw Hill,1957,ISBN-0-471-46890-8

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with POs

	Programme outcomes										
CO/ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	L	M	L	-	-	-	L	L	-	-
CO2	H	H	H	L	-	-	-	M	L	-	-
CO3	M	H	H	M	L	-	-	M	L	-	-
CO4	M	H	H	M	L	-	-	L	L	-	-

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	**PSO2**
CO1	L	-
CO2	M	-
CO3	H	-
CO4	H	-

ADVANCED STRUCTURAL ANALYSIS (Elective 6)						
Course Code	**:**	**16MST332**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S :: 4:0:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**04**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO): Student shall be able to

1	Discuss concepts of stresses, moments, deformation and pressure in beams and columns
2	Interpret the influence of stresses, moments, deformation and pressure on beams and columns
3	Apply concepts of mathematics to solve problems related to beams and columns
4	Calculate stresses, moments, deformation and pressure in beams and columns

UNIT – I	**09Hrs**

Beams on elastic foundations: Differential equations of elastic line interpretation of constants of integration, infinite beam with c
oncentrated load, moment and UDL and problems related to infinite beams. Semi-infinite beams with concentrated load, moment and UDL, semi-infinite beam with fixed and hinged conditions, problems on semi-infinite beams.

UNIT – II	**10Hrs**

Beam-Column: Governing differential equation for axial and lateral loads, analysis of beam columns subjected to axial and concentrated loads, axial and UDL, beam column with different end conditions.

UNIT – III	**10Hrs**

Buckling of Columns: Assumptions, Euler's theory of buckling governing differential equation, prismatic columns with different end conditions, obtaining the characteristic equation for the critical load for non-prismatic columns, buckling of frames.

UNIT – IV	**10Hrs**

Unsymmetrical bending of beams: Introduction, stresses in beams, deflections of beams subjected to unsymmetrical bending, problems related to unsymmetrical bending.
Shear Centre: introduction, shear center for symmetrical and unsymmetrical sections, problems related to shear center.

UNIT – V	**09Hrs**

Plastic Analysis of Structures: Introduction, plastic moment of resistance, plastic modulus, shape factors, moment – curvature relationship, plastic hinge and mechanism, analysis of indeterminate beams and frames, upper and lower bound theorem, ultimate strength of fixed and continuous beams, applications of static and kinematic theorem for plastic analysis of beams and frames.

Expected Course Outcomes:
After successful completion of this course the student will be able to:

1	Explain concepts of stress, moment, deflection in beams, columns and beam columns.
2	Examine the influence of deflection, moments and shear force on beams and columns.
3	Analyze beams on elastic foundation, beam column and unsymmetrical bending of beams.

4	Evaluate stresses, moments and deflections in beams and columns

Reference Books:

1	Boresi A.P., and Sidebottom O.M., (1985), Advanced Mechanics of Materials, John Wiley and sons in N.Y., ISBN 10: 0471843237 ISBN 13: 9780471843238
2	Den Hartog, (1952), Advanced Strength of Materials, McGraw Hill, N.Y.,ISBN:9780486654072
3	N. Krishna Raju and D.R. Gururaja, (1997), Advanced Mechanics of solids and structures, Narosa Publishing House, New Delhi, ISBN, 8173190666, 9788173190667
4	N.Subramanian, Design of steel structures, Oxford University Press, ISBN-13:978-0-19-567681-5,ISBN-10:0-19-567681-5.
5	William F. Riley, Leroy D. Sturges and Don H. Morris, (2001), Mechanics of Materials, John Wiley & Sons, New Delhi, ISBN: 978-0-471-43446-7

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with Pos

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	-	-	-	-	-	-	-	-
CO2	H	H	M	-	L	-	-	L	-	-	-
CO3	H	H	-	-	-	-	-	-	H	-	-
CO4	H	H	M	H	-	-	-	L	H	-	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	M	-
CO2	M	-
CO3	H	-
CO4	H	-

DESIGN OF BRIDGES, FLYOVERS AND GRADE SEPARATORS (Elective 7)			
Course Code:	**16MST341**		**CIE Marks: 100**
Hrs/Week:	**L:T:P:S:: 4:0:0:0**		**SEE Marks: 100**
Credits:	**4+0+0+0**		**SEE : 3 Hrs**

Course objectives: This course will enable students to

1	Describe the types and components of a bridge with specifications for designing them for highways.
2	Discuss the use of different types of bridge bearings, their installation and maintenance aspects under the action of vehicular loads.
3	Examine the design aspects of bridge approaches for RCC, PSC and Steel bridges.
4	Analyze the loading conditions on the bridges and design the elements as per IRC load specificatios.
5	Identify the quality control measures during the execution of bridges both for substructure and super structure portions of the bridge.

UNIT – I	
Introduction: Historical Developments, Site Selection for Bridges, Classification of Bridges Forces on Bridges. Bridge substructures: Abutments, wing walls	**09 Hours**
UNIT – II	
Box Culvert: Different Loading Cases IRC Class AATracked, Wheeled and Class A Loading, working out the worst combination of loading, Moment Distribution, Calculation of BM & SF, Structural Design of Slab Culvert,with Reinforcement Details.	**10 Hours**
UNIT – III	
T Beam Bridge Slab Design: Proportioning of Components Analysis of interior Slab & Cantilever Slab Using IRC Class AA Tracked, Wheeled Class A Loading, Structural Design of Slab, with Reinforcement Detail. T Beam Bridge Cross Girder Design: Analysis of Cross Girder for Dead Load & LiveLoad Using IRC Class AA Tracked, Wheeled Class A Loading A Loads, Structural Design of Beam, with Reinforcement Detail.	**10 Hours**
UNIT – IV	
Importance of Bearings – Types of bearings, Bearings for slab bridges – Bearings for girder bridges – Design of Elastomeric bearing – Joints – Expansion joints, repair and rehabilitation of concrete bridges.	**10 Hours**
UNIT – V	
PSC Bridges: Introduction to Pre and Post Tensioning, Proportioning of Components, Analysis and Structural Design of Slab, Analysis of Main Girder using COURBON's Method for IRC Class AA tracked vehicle, Calculation of pre-stressing force and eccentricity, cable profile and calculation of stresses, Design of End block and detailing of main girder	**09 Hours**

Course outcomes:
After studying this course, students will be able to:

1.	Explain the components of a bridge following the specifications for highways.
2.	Compare different types of bridge bearings, their installation and maintenance aspects under the action of vehicular loads.

3.	Analyse the IRC loading conditions for the design of bridges.
4.	Evaluate the design aspects of bridge approaches for RCC, PSC and Steel bridges.

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Reference Books:

1	D.Johnson Victor, "Essentials of bridge Engineering"- Oxford, IBH publishing company, ISBN, 8120417178, 9788120417175
2	Ponnuswamy, "Bridge Engineering"-McGraw Hill Publication, 1989, ISBN-10: 0070656959
3	Vazirani Ratwani & M.G.Aswani, "Design of Concrete Bridges"- Khanna Publishers, 2004 New Delhi, ISBN-13. 978-81-7409-117-3. ISBN-10
4	Design of Bridges"- Dr. Krishna Raju, Oxford & IBH Publishing company Limited, 2001, ISBN978-81-204-1741-0 788120 114 17410

Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE) for Theory

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with Pos

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	-	-	-	-	-	L	-	-	-
CO2	H	M	H	-	-	-	-	-	-	H	-
CO3	H	H	H	-	-	-	-	-	-	H	H
CO4	H	H	H	H	-	-	-	-	-	-	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	-
CO2	H	-
CO3	H	-
CO4	H	-

EARTH RETAINING STRUCTURES (Elective 7)			
Course Code:	**16MST342**		**CIE Marks: 100**
Hrs/Week:	**L:T:P :S :: 4:0:0:0**		**SEE Marks: 100**
Credits:	**04**		**SEE : 3 Hrs**

Course Learning Objectives:	
1	Understand the significance of earth retaining structures in Civil Engineering applications
2	Evaluate the lateral earth pressures associated with different earth systems
3	Analyse the different types of earth retention system
4	Design the earth retaining structures used for support of fills and excavations

PART-A	
UNIT – I	**10 Hrs**
Earth Pressure Theories : Introduction – State of stress in retained soil mass – Earth pressure theories –Classical and graphical techniques – Active and passive cases – Earth pressure due to external loads, empirical methods, Wall movement.	
UNIT – II	**09 Hrs**
Compaction, Drainage and Stability of retaining Structures Retaining structure – Selection of soil parameters , Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. Earth pressure due to earthquake forces , Stability of retaining structure.	
UNIT – III	**09 Hrs**
Sheet Pile Walls Retaining structure – Selection of soil parameters – Analysis and design of cantilever and anchored sheet pile walls. Dead man and continuous anchor. Diaphragm and bored pile walls – Design requirements.	
UNIT – IV	**10Hrs**
Supported Excavations Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos ,Soil anchors, Soil pinning , Soil nailing – Basic design concepts	
UNIT – V	**10Hrs**
Design Of Reinforced Earth Retaining Wall Reinforced earth retaining wall – principles, Concepts and mechanism of reinforced Earth – Design consideration of reinforced earth – Materials used in reinforced earth - Geotextile – Geogrids, Metal strips, facing elements.	

Course outcomes: **After going through this course the student will be able to:**	
1	Enumerate the types of earth retention system

2	Predict the Suitability of earth system for a particular project
3	Quantify the lateral earth pressures associated with different earth systems.
4	Select the most technically appropriate and cost-effective type of retaining wall for the application

Reference Books

1	R F Craig, "Soil Mechanics", Van Nostrand Reinhold International publication, ISBN 10: 0278000193 ISBN 13: 9780278000193
2	Chris R.I. Clayton, Rick I. Woods, Andrew J. Bond, Jarbas Milititsky "Earth pressure and Earth retaining structures", Third edition, CRC Press, 2014 ISBN 9781466552111
3	Koerner, R.M., "Design with Geosynthetics" Sixth Edition, Prentice Hall, 2012. ISBN-13: 978-1462882892 ,10: 1462882897
4	Das, B.M.," Principles of Geotechnical Engineering" Fourth Edition, The PWS series in Civil Engineering, 1998 ISBN-10: 0534951791 ,ISBN-13: 978-0534951795

Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE) for Theory

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with Pos

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	H	-	-	-	-	L	-	-	-
CO2	H	M	H	-	-	-	-	-	-	H	H
CO3	H	H	H	H	-	-	-	-	-	H	H
CO4	H	M	H	H	-	-	-	-	-	H	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	-
CO2	-	M
CO3	M	-
CO4	L	-

INTERNSHIP / INDUSTRIAL TRAINING						
Course Code	**:**	**16MST35**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:6:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**3**		**SEE Duration**	**:**	**30 min**

GUIDELINES FOR INTERNSHIP

Course Learning Objectives (CLO):

The students shall be able to:

1	Understand the process of applying engineering knowledge to produce product and provide services.
2	Explain the importance of management and resource utilization
3	Comprehend the importance of team work, protection of environment and sustainable solutions.
4	Imbibe values, professional ethics for life long learning.

1) The duration of the internship shall be for a period of 8 weeks on full time basis between II semester final exams and beginning of III semester.
2) The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3) Internship must be related to the field of specialization or the M.Tech program in which the student has enrolled.
4) Students undergoing internship training are advised to use ICT tools such as skype to report their progress and submission of periodic progress reports to the faculty members.
5) Every student has to write and submit his/her own internship report to the designated faculty.
6) Students have to make a presentation on their internship activities in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the internship final report. However interim or periodic reports and reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
7) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
8) The broad format of the internship final report shall be as follows

- Cover Page
- Certificate from College
- Certificate from Industry / Organization
- Acknowledgement
- Synopsis
- Table of Contents
- Chapter 1 - Profile of the Organization – Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
- Chapter 2 - Activities of the Department -
- Chapter 3 – Tasks Performed – summaries the tasks performed during 8 week period
- Chapter 4 – Reflections – Highlight specific technical and soft skills that you acquired during internship
- References & Annexure

Course Outcomes:

After going through the internship the student will be able to:

CO1: Apply engineering and management principles

CO2: Analyze real-time problems and suggest alternate solutions

CO3: Communicate effectively and work in teams

CO4: Imbibe the practice of professional ethics and need for lifelong learning.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of the Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation of the application of engineering knowledge in industries 35%

(2) Ability to comprehend the functioning of the organization/ departments 20%

(3) Importance of resource management, environment and sustainability 25%

(4) Presentation Skills and Report 20%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	H	M		M				L	
CO2				H	M	M		L			
CO3					L		M	H	H		
CO4					L		H			M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	H
CO2	H	H
CO3	-	M
CO4	H	H

GUIDELINES FOR INDUSTRIAL TRAINING

Course Learning Objectives (CLO):

The students shall be able to:

1	Understand the process of applying engineering knowledge to industrial products & processes
2	Explain the importance of skilling, training and resource management.
3	Comprehend the importance of team work, communication and sustainable solutions.
4	Imbibe values, professional ethics for life long learning.

1) The duration of industrial training must be for a minimum of 1 week and maximum of 8 weeks on full time basis.
2) Industrial Training in which students pays a fee to the organization / industry will not be considered.
3) He/she can undergo training in one or more industry /organization.
4) The student must submit letters from the industry clearly specifying his / her name and the duration of the training provided by the company with authorized signatures.
5) Industrial training must be related to the field of specialization or the M.Tech program in which the student has enrolled.
6) Students undergoing industrial training are advised to use ICT tools such as skype to report their progress and submission of periodic progress reports to the faculty members.
7) Every student has to write and submit his/her own industrial training report to the designated

faculty.

8) Students have to make a presentation on their industrial training in front of the departmental cmmittee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the final report.

9) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.

10) The broad format of the industrial training report shall be as follows

- Cover Page
- Certificate from College
- Training Certificate from Industry / Organization
- Acknowledgement
- Executive Summary
- Table of Contents
- Chapter 1 - Profile of the Organization –Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices
- Chapter 2 – Details of the Training Modules
- Chapter 3 – Reflections – Highlight specific technical and soft skills that you acquired

References & Annexure

Course Outcomes:

After going through the industrial training the student will be able to:

CO1:	Understand the process of applying engineering knowledge to solve industrial problems
CO2:	Develop skills through training relevant to industrial requirement
CO3:	Communicate effectively and work in teams
CO4:	Imbibe ethical practices and develop it as life skill.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation on the application of engineering knowledge 25%

(2) Ability to comprehend the importance of skilling and training 25%

(3) Importance of communication, professional ethics, sustainability 20%

(4) Oral Presentation and Report 30%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	M	H	M		M	-	-	-	L	-
CO2	-	-	-	H	M	M		L	-	-	-
CO3	-	-	-	-	L	-	M	H	H	-	-
CO4	-	-	-	-	L	-	H	-	-	M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	-
CO2	H	-
CO3	-	M
CO4	H	H

GUIDELINES FOR INDUSTRIAL VISITS

Course Learning Objectives (CLO):

The students shall be able to:

1	Understand the role of industries and service organization in meeting the demands of the society.
2	Explain the working of different industries and organizations with an engineering perspective
3	Comprehend the importance of team work, communication and sustainable solutions.
4	Imbibe values, professional ethics for life long learning.

1) Student must visit a minimum of THREE organizations/industry. The duration of the visit per organization must be for ONE full day, during which he/she must comprehend the importance of organization structure, function of various departments, application of engineering knowledge, resource management, importance to environment and safety, professional ethics.

2) It is mandatory to visit ONE private multi-national company or public sector industry / organization, ONE medium-small enterprise and ONE rural based or NG organization.

3) The student must submit letter from the industry clearly specifying his / her name and the date of visit to the industry with authorized signatures.

4) Industrial visit must be related to the field of specialization or the M.Tech program in which the student has enrolled.

5) Every student has to write and submit his/her own report on each industrial visit and submit the report to the designated faculty advisor for evaluation.

6) A photograph outside the industry with the name and logo of the industry in the background along with the students and faculty members could be included in the report.

7) Students have to make a presentation on their industrial visit in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the final report.

8) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.

9) The broad format of the industrial visit report shall be as follows

- Cover Page
- Certificate from College
- Acknowledgement
- Synopsis / Executive Summary
- Table of Contents
- Chapter 1 - Profile of the PSU or MNC – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
- Chapter 2 – Profile of the SME – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
- Chapter 3 - Profile of the NGO – must include Organizational structure, services, Manpower, Societal Concerns, Professional Practices
- Chapter 4 – Comparative Analysis of PSU/MNC – SME – NGO
- References & Annexure (Permission letters from the organizations for the visit & photographs)

Course Outcomes:

After going through this course the student will be able to:

CO1:	Classify the role of different industries and organization in addressing the needs of the society.
CO2:	Explain the process of applying engineering knowledge in industries and organizations.

CO3:	Describe the importance of communication and team work
CO4:	Recognize the importance of practicing professional ethics and need for life skills.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation of the application of engineering knowledge in industries 25%

(2) Ability to comprehend the functioning of the organization/ departments 30%

(3) Importance of resource management, environment and sustainability 20%

(4) Presentation Skills and Report 25%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	M	H	M	-	M	-	-	-	L	-
CO2	-	-	-	H	-	M	-	L	-	-	-
CO3	-	-	-	-	L	-	-	H	H	-	-
CO4	-	-	-	-	L	-	H	-	-	-	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	-
CO2	H	H
CO3	-	M
CO4	H	H

TECHNICAL SEMINAR						
Course Code	**:**	**16MST36**		**CIE Marks**	**:**	**50**
Hrs/Week	**:**	**L:T:P:S**	**0:0:4:0**	**SEE Marks**		**50**
Credits	**:**	**2**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):

The students shall be able to:

1	Understand the technological developments in their chosen field of interest
2	Explain the scope of work and challenges in the domain area
3	Analyze these engineering developments in the context of sustainability and societal concerns
4	Improve his/her presentation skills and technical report writing skills

GUIDELINES

1) The presentation will have to be done by individual students.
2) The topic of the seminar must be in one of the thrust areas with in-depth review and analysis on a current topic that is relevant to industry or on-going research.
3) The topic could be an extension or complementary to the project
4) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
5) Each student must submit both hard and soft copies of the presentation.

Course Outcomes:

After going through this course the student will be able to:

CO1:	Identify topics that are relevant to the present context of the world
CO2:	Perform survey and review relevant information to the field of study.
CO3:	Enhance presentation skills and report writing skills.
CO4:	Develop alternative solutions which are sustainable

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

Rubrics for Evaluation:

1) Topic – Technical Relevance, Sustainability and Societal Concerns 15%
2) Review of literature 25%
3) Presentation Skills 35%
4) Report 25%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	H	M	M	L	H	H	-	-	-	M
CO2	L	M	-	-	-	-	-	-	-	H	-
CO3	-	-	-	-	-	-	L	M	H	-	-
CO4	-	L	M	-	H	H	-	-	-	-	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	L	H
CO2	-	M
CO3	M	M
CO4	-	H

IV SEMESTER

MAJOR PROJECT						
Course Code	**:**	**16MST41**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:52:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**26**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1	Understand the method of applying engineering knowledge to solve specific problems.
2	Apply engineering and management principles while executing the project
3	Demonstrate good verbal presentation and technical report writing skills.
4	Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be done by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The number of projects that a faculty can guide would be limited to three.
5. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
6. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
7. It is mandatory for the student to present his/her work in one of the international conferences

or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this course the students will be able to

CO1:	Conceptualize, design and implement solutions for specific problems.
CO2:	Communicate the solutions through presentations and technical reports.
CO3:	Apply project and resource managements skills, professional ethics, societal concerns
CO4:	Synthesize self-learning, sustainable solutions and demonstrate life long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase	Activity	Weightage
I 5th week	Synopsis, Preliminary report for the approval of selected topic along with literature survey, objectives and methodology.	20%
II 10th week	Mid-term progress review shall check the compliance with the objectives and methodology presented in Phase I, review the work performed.	40%
III 15th week	Oral presentation, demonstration and submission of project report. After this presentation, the student will have one week time to correct / modify his report to address the issues raised by the committee members.	40%

CIE Evaluation shall be done with marks distribution as follows:

- Selection of the topic & formulation of objectives 10%
- Design and simulation/ algorithm development/experimental setup 25%
- Conducting experiments / implementation / testing / analysis 25%
- Demonstration & Presentation 20%
- Report writing 20%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be

given for the examination. Evaluation will be done in batches, not exceeding 6 students.

1. Brief write-up about the project 5%
2. Formulation of Project Objectives & Methodology 20%
3. Experiments / Analysis Performed; Results & Discussion 25%
4. Report 20%
5. Viva Voce 30%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	M	L	M	L	-	-	-	-
CO2	-	-	-	L	-	-	-	M	H	-	-
CO3	-	-	-	-	L	M	M	-	-	H	-
CO4	-	-	-	-	L	M	H	M	-	-	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	-
CO2	-	M
CO3	H	H
CO4	-	H

SEMINAR						
Course Code	**:**	**16MST42**		**CIE Marks**	**:**	**50**
Hrs/Week	**:**	**L:T:P:S**	**0:0:4:0**	**SEE Marks**		**50**
Credits	**:**	**2**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):

The students shall be able to:

1	Understand the technological developments in their chosen field of interest
2	Explain the scope of work and challenges in the domain area
3	Analyze these engineering developments in the context of sustainability, societal concerns and project management.
4	Improve his/her verbal presentation and report writing skills

GUIDELINES

1) The presentation will have to be done by individual students.
2) The topic of the seminar must be in one of the thrust areas with in-depth review and analysis on a current topic that is relevant to industry or on-going research.
3) The topic could be an extension or complementary to the project topic.
4) Topics could be in multidisciplinary areas and strongly address the technical design issues.
5) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
6) The students must mandatorily address legal, ethical issues as related to the topic of study.
7) The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study.
8) Each student must submit both hard and soft copies of the presentation.

Course Outcomes:

After going through this course the student will be able to:

CO1:	Identify topics that are relevant in the present context of the world and relate it to sustainability and societal relevance
CO2:	Perform literature/market/product survey and analyse information to the field of study
CO3:	Enhance presentation and report writing skills.
CO4:	Develop creative thinking abilities

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of TWO senior faculty members. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

Rubrics for Evaluation:

- Topic – Technical Relevance, Sustainability and Societal Concerns 15%
- Literature Review 25%
- Presentation Skills 35%
- Report 25%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	H	M	M	L	H	H	--	---	---	M
CO2	L	M	-	-	-	-	-	-	-	H	-
CO3	-	-	-	-	-	-	L	M	H	-	-
CO4	-	L	M	-	H	H	-	-	-	-	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	-	M
CO2	-	H
CO3	-	M
CO4	H	H