RV College of Engineering®

Master of Technology (M.Tech)
in

STRUCTURAL ENGINEERING (MST)

Scheme And Syllabus Of I & IV Semester
(2022 Scheme)

B.E. Programs : AI, AS, BT, CH, CS, CV, CD, CY, EC, EE, EI, ET, IM, IS, ME.
M. Tech (13) MCA, M.Sc. (Engg.)
Ph.D. Programs : All Departments are recognized as Research Centres by VTU Except AI & AS

2024

96TH
NIRF RANKING IN ENGINEERING (2023)

TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023
1501+
TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023 (ASIA)
501-600

EDUFUTURE EXCELLENCE AWARD
BEST PRIVATE ENGINEERING UNIVERSITY (SOUTH)
BY ZEE DIGITAL

1001+
SUBJECT RANKING (ENGINEERING)

801+
SUBJECT RANKING (COMPUTER SCIENCE)

IIRF 2023
ENGINEERING RANKING INDIA
NATIONAL RANK-10
STATE RANK - 2
ZONE RANK - 5

QS-IGUAGE DIAMOND UNIVERSITY RATING (2021-2024)

CURRICULUM STRUCTURE

61 CREDITS PROFESSIONAL CORES (PC)

23 CREDITS BASIC SCIENCE

22 CREDITS ENGINEERING SCIENCE

18 CREDITS PROJECT WORK / INTERNSHIP

12 CREDITS* OTHER ELECTIVES & AEC

12 CREDITS PROFESSIONAL ELECTIVES

12 CREDITS HUMANITIES & SOCIAL SCIENCE

160 CREDITS TOTAL

*ABILITY ENHANCEMENT COURSES (AEC), UNIVERSAL HUMAN VALUES (UHV), INDIAN KNOWLEDGE SYSTEM (IKS), YOGA.

17
Centers of Excellence

11
Centers of Competence

1381
Publications On Web Of Science

397
Publications On Web Of Science

78
Patents Filed

1699
Citations

38
Patents Granted

58
Published Patents

MOUS: 90+WITH INSDUSTRIES / ACADEMIC INSTITUTIONS IN INDIA & ABROAD

EXECUTED MORE THAN RS.40 CRORES WORTH SPONSORED RESEARCH PROJECTS & CONSULTANCY WORKS SINCE 3 YEARS

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

Go, change the world®

STRUCTURAL ENGINEERING

SCHEME & SYLLABUS of I TO IV SEMESTER

2022 SCHEME

Glossary of Abbreviations

1.	AS	Aerospace Engineering
2.	BS	Basic Sciences
3.	BT	Biotechnology
4.	CH	Chemical Engineering
5.	CHY	Chemistry
6.	CIE	Continuous Internal Evaluation
7.	CS	Computer Science & Engineering
8.	CV	Civil Engineering
9.	EC	Electronics & Communication Engineering
10.	EE	Electrical & Electronics Engineering
11.	EI	Electronics & Instrumentation Engineering
12.	ET	Electronics & Telecommunication Engineering
13.	GE	Global Elective
14.	HSS	Humanities and Social Sciences
15.	IM	Industrial Engineering & Management
16.	IS	Information Science & Engineering
17.	L	Laboratory
18.	MA	Mathematics
19.	MBT	M. Tech in Biotechnology
20.	MCE	M. Tech. in Computer Science & Engineering
21.	MCN	M. Tech. in Computer Network Engineering
22.	MCS	M. Tech. in Communication Systems
23.	MDC	M. Tech. in Digital Communication
24.	ME	Mechanical Engineering
25.	MHT	M. Tech. in Highway Technology
26.	MIT	M. Tech. in Information Technology
27.	MMD	M. Tech. in Machine Design
28.	MPD	M. Tech in Product Design & Manufacturing
29.	MPE	M. Tech. in Power Electronics
30.	MSE	M. Tech. in Software Engineering
31.	MST	M. Tech. in Structural Engineering
32.	MVE	M. Tech. in VLSI Design & Embedded Systems
33.	N	Internship
34.	P	Projects (Minor / Major)
35.	PHY	Physics
36.	SDA	Skill Development Activity
37.	SEE	Semester End Examination
38.	T	Theory
39.	TL	Theory Integrated with Laboratory
40.	VTU	Visvesvaraya Technological University

POSTGRADUATE PROGRAMS

Sl. No	Core Department	Program	Code
1.	BT	M. Tech in Biotechnology	MBT
2.	CS	M. Tech in Computer Science & Engineering	MCE
3.	CS	M. Tech in Computer Network Engineering	MCN
4.	CV	M. Tech in Structural Engineering	MST
5.	CV	M. Tech in Highway Technology	MHT
6.	EC	M. Tech in VLSI Design & Embedded Systems	MVE
7.	EC	M. Tech in Communication Systems	MCS
8.	EE	M. Tech in Power Electronics	MPE
9.	ET	M. Tech in Digital Communication	MDC
10.	IS	M. Tech in Software Engineering	MSE
11.	IS	M. Tech in Information Technology	MIT
12.	ME	M. Tech in Product Design & Manufacturing	MPD
13.	ME	M. Tech in Machine Design	MMD

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 civil engineering and allied fields.
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.

PROGRAMME OUTCOMES (PO)

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

PO1: Independently carry out research / investigation and development work to solve practical problems in Structural Engineering.

PO2: Write and present a substantial technical report/document in the area of Structural Engineering

PO3: Demonstrate a degree of mastery in use of materials, analysis and design for structural components.

PO4: Use modern tools for analysis and design of structural systems.

PO5: Adopt safety and ethical practices in structural design for a sustainable environment. PO6: Exhibit multidisciplinary and managerial skills, with a commitment to lifelong learning.

INDEX

M.Tech in Structural Engineering: MST

I SEMESTER M.Tech

Sl. No.	Course Code	Course Title	Credit Allocation L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MMA201T	Computational Mathematics	3	1	0	**4**	MA	Theory	1.5	100	3	100
2	MST301I	Computational Structural Mechanics	3	0	1	**4**	CV	Theory+Lab	1.5	100	3	100
3	MST301T	Advanced Design of Reinforced Concrete Structures	3	1	0	**4**	CV	Theory	1.5	100	3	100
4	MST301L	Analysis and Design of Structures Lab-1	1	0	1	**2**	CV	Lab	1.5	50	3	50
5	MST301AX	Elective A (Professional Elective)	3	0	0	**3**	CV	Theory	1.5	100	3	100
6	MST301BX	Elective B (Professional Elective)	3	0	0	**3**	CV	Theory	1.5	100	3	100

Note: For the course code 22HSS42, Students need to select one ONLINE MOOC course as recommended by HSS BoS. This course can be selected anytime between I to III semester and it will be evaluated during IV semester.

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Code	Elective A (Professional Elective)	Code	Elective B (Professional Elective)
MST301A1	Finite Element Method of Analysis	MST301B1	Advanced Structural Analysis
MST301A2	Forensic Engineering and Rehabilitation of Structures	MST301B2	Mechanics of Deformable Bodies
MST301A3	High Rise Structures	MST301B3	Design of Masonary Structures

II SEMESTER M.Tech

Sl. No.	Course Code	Course Title	Credit Allocation L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MIM431T	Research Methodology	3	0	0	**3**	IS	Theory	1.5	100	3	100
2	MST331I	Structural Dynamics	3	0	1	**4**	CV	Theory+Lab	1.5	100	3	100
3	MST331T	Advanced Design of Steel Structures	3	0	0	**3**	CV	Theory	1.5	100	3	100
4	MST331CX	Elective C (Professional Elective)	3	0	0	**3**	CV	Theory	1.5	100	3	100
5	MXX33XG	Elective D (Global Elective)	3	0	0	**3**	Res. BoS	Theory	1.5	100	3	100
6	MST331L	Analysis and Design of Structures lab-2	1	0	1	**2**	CV	Lab	1.5	50	3	50
7	MHS131T	Professional Skills Development-I	2	0	0	**2**	HSS	Theory*	1.5	50	2	50

** External Agency will be conducting the classes and both CIE and SEE will be evaluated by the Agency.*

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Code	Elective C (Professional Elective)
MST331C1	Design of Concrete Bridges
MST331C2	Design for Safety
MST331C3	Precast Concrete structures 2022 SCHEME
MST331C4	Sustainable Construction Practices

Elective D (Global Elective)			
MBT331G	Bioinspired Engineering	MET331G	Tracking and Navigation Systems
MBT332G	Health Informatics	MIM331G	Project Management
MCS331G	Business Analytics	MIS331G	Database and Information Systems
MCV331G	Industrial and Occupational Health and Safety	MIS332G	Management Information Systems
MCV332G	Intelligent Transportation Systems	MMA331G	Statistical and Optimization Methods
MEC331G	Electronic System Design	MME331G	Industry 4.0
MEC332G	Evolution of Wireless Technologies		

III SEMESTER M.Tech

Sl. No.	Course Code	Course Title	Credit Allocation L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MST361T	Advanced Construction Materials	3	1	0	**4**	CV	Theory	1.5	100	3	100
2	MST361DX	Elective E (Professional Elective)	3	1	0	**4**	CV	Theory	1.5	100	3	100
3	MST461N	Internship	0	0	6	**6**	CV	Internship	1.5	50	3	50
4	MST461P	Minor Project	0	0	6	**6**	CV	Project	1.5	50	3	50
						20						

Code	Elective E (Professional Elective)
MST361D1	Structural Reliability
MST361D2	Earthquake Resistant Structures
MST361D3	Stability of Structures

IV SEMESTER M.Tech

Sl. No.	Course Code	Course Title	Credit Allocation L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MST491P	Major Project	0	0	18	**18**	CV	Project	1.5	100	3	100
2	MHS191	Professional Skills Development-II	2	0	0	**2**	HSS	NPTEL	--	50	ONLINE	50
Student need to submit the certificate for the evaluation of Course code 22HSS42												
						20						

SEMESTER: I							
Course Code	:	MMA201T	**COMPUTATIONAL MATHEMATICS**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Common Course (MPD, MMD, MPE, MBT, MST, MHT)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. A Sujatha			

UNIT - I	**09 Hrs**
Vector Spaces and Orthogonality: Vector spaces and subspaces, linear independence, basis and dimension, four fundamental subspaces, change of basis. Inner product, orthogonal vectors, orthogonal projections, orthogonal bases. Eigen subspaces, Gram-Schmidt orthogonalization process, QR factorization and singular value decomposition.	
UNIT - II	**09 Hrs**
Multiple Random variables: Joint probability mass functions and probability density functions, marginal density function, conditioning of random variables, statistical independence, correlation and covariance functions, covariance and correlation matrices, transformation of random variables, Markov and Chebyshev inequalities, Gaussian distribution-Multivariate normal density and its properties.	
UNIT - III	**08 Hrs**
Principal component analysis and Factor analysis: Overview of principal component analysis and factor analysis, eigen structure of covariance or correlation matrix. Principal component-standardized variables, covariance matrices. Factor model-principal component method, maximum likelihood method, factor scores, factor rotation.	
UNIT - IV	**08 Hrs**
Engineering optimization: Engineering applications of optimization, statement of an optimization problem-design vector, design constraints, constraint surface, objective function and objective function surface. Multivariable optimization with inequality constraints-Kuhn-Tucker conditions, constraint qualification.	
UNIT - V	**08 Hrs**
Numerical solution of differential equations: Boundary value problems–finite difference method for linear and nonlinear problems, shooting method and Galerkin method. Finite difference methods for parabolic, elliptic and hyperbolic partial differential equations.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Illustrate the fundamental concepts of distributions, linear algebra, differential equations and optimization arising in various fields engineering.
CO2	Derive the solution by applying the acquired knowledge and skills of statistical/numerical/optimization techniques to solve problems of probability distributions, linear algebra and differential equations.
CO3	Evaluate the solution of the problems using appropriate statistical numerical and optimization techniques to the real world problems arising in many practical situations.
CO4	Compile the overall knowledge of probability distributions, linear algebra and optimization methods gained to engage in life – long learning.

Reference Books	
1.	Richard A Johnson and Dean W Wichern, "Applied Multivariate Statistical Analysis", Pearson Prentice Hall, 6th Edition, 2007, , ISBN-13: 978-0-13-187715-3, ISBN-10: 0-13-187715-1.
2.	Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4th Edition, 2006, ISBN 97809802327.
3.	Edgar G. Goodaire "Linear Algebra: Pure & Applied Kindle Edition", World Scientific, 1st Edition, 2013, ISBN-13: 978-9814508360.

4.	M K Jain, S. R. K. Iyengar, R. K. Jain; Numerical methods for scientific and engineering computation; New Age International Publishers; 6th edition; 2012; ISBN-13: 978-81-224-2001-2.
5.	Singiresu S. Rao, Engineering Optimization Theory and Practice, New Age International (P)Ltd., 3rd edition, ISBN: 81-224-1149-5.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301I	**COMPUTATIONAL STRUCTURAL MECHANICS**	CIE Marks	:	100
Credits L-T-P	:	3-0-1	*(Theory & Practice)*	SEE Marks	:	100
Hours	:	42L + 28P	*(Professional Core - 1)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			DR.Ravindra.R			

UNIT - I	**8 Hrs**
Static and Kinematic indeterminacy of rigid jointed frames, trusses and grids. Concepts of stiffness and flexibility, Properties of stiffness and flexibility matrix. Relationship between stiffness matrix and flexibility matrix.	
UNIT - II	**8 Hrs**
Development of structure stiffness matrices for two dimensional rigid jointed structures using basic fundamental approach, development of flexibility matrix for two dimensional determinate rigid jointed structures.	
UNIT - III	**9 Hrs**
Displacement-transformation matrix using Stiffness Method, Development of global stiffness matrix for continuous beams, plane trusses and rigid plane frames (having not more than six degrees of freedom – 6x6 stiffness matrix), Analysis of continuous beams, plane trusses and rigid plane frames by stiffness method (having not more than 3 degrees of freedom – 3x3 stiffness matrix). Analysis considering effect of sinking of supports, temperature, linear and rotational springs.	
UNIT - IV	**9 Hrs**
Development of element stiffness matrix, global stiffness matrix by direct stiffness method for two dimensional beams, frames and trusses (having not more than six degrees of freedom – 6x6 stiffness matrix), Analysis of continuous beams, plane trusses and rigid plane frames by direct stiffness method (having not more than 3 degrees of freedom – 3x3 stiffness matrix). (Note- matrix of order 6 x 6 to be supplied)	
UNIT - V	**8 Hrs**
Principles of analysis of three-dimensional space truss, grid structures using direct stiffness method-development of structure stiffness matrix. Numerical problems restricted to three degrees of freedom. (Note- matrix of order 6 x 6 to be supplied)	
LABORATORY	**28 Hrs**
Analysis using MATLAB Software (Note- matrix of order 6 x 6 to be supplied) 1) Analysis of 2D plane trusses by displacement transformation stiffness method. 2) Analysis of 2D rigid plane frames by displacement transformation stiffness method. 3) Analysis of 2D plane trusses by direct stiffness method. 4) Analysis 2D rigid plane frames by direct stiffness method. 5) Analysis of grid beams. 6) Analysis of three-dimensional pin jointed structures	

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

CO1	:	Demonstrate the concepts of matrix methods to develop co-ordinate system for trusses, beams, and frames and to develop stiffness and flexibility matrix by elementary approach.
CO2	:	Apply knowledge of local and global coordinate system to develop displacement transformation matrices and structure stiffness matrix.

CO3	:	Analyze two- and three-dimensional structures using matrix methods by analytical methods and software tools with different degrees of freedom.
CO4	:	Evaluate response of structural elements under different support conditions.

Reference Books

1. Computational Structural Mechanics, S.Rajasekaran, G. Sankarasubramanian, 7th Edition, 2015,Prentice-Hall of India Pvt Ltd, , NewDelhi-110092.ISBN-13: 978-8120317345,ISBN-10:8120317343.

2. Computer Analysis of Framed Structures, Damodar Maity, 2007, I K International Publishing House Pvt. Ltd.,
ISBN-13: 978-8189866198.

3. Getting started with MatLab ,Rudra Pratap, 2010,Oxford University Press, ISBN: -13:978-0-19-806919-5

4. Matlab An introduction with applications,Amos Gilat, 4th edition 2012, Wiley Publications, ISBN-13:
978-8126537204.

Scheme of Continuous Internal Evaluation (CIE): 10 + 30 + 30 + 30 = 100
QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The average of two quizzes will be the Final Quiz marks.
TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 30 Marks.
EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (10), Video based seminar
/presentation /demonstration (20) adding upto 30 marks.
Laboratory: Conduction of laboratory exercises, Lab report & observation & analysis (30 Marks), Lab Test (10 Marks) & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks. The final marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks: Each unit consists of TWO Questions of 16 Marks each. Answer FIVE full questions selecting one from each unit (from 1 to 5). Question No. 11 is compulsory
(Laboratory component) for 20 Marks.

Rubric for CIE & SEE for Integrated Theory courses with Laboratory

RUBRIC of CIE			***RUBRIC of SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	10	Each unit consists of TWO questions of 16 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.		
2	Tests - T1 & T2	30			
3	Experiential Learning - EL1 & EL2	30	1 & 2	Unit-1: Question 1 or 2	16
4	Laboratory	30	3 & 4	Unit-2: Question 3 or 4	16
	Total Marks	100	5 & 6	Unit-3: Question 5 or 6	16
NO SEE for Laboratory			7 & 8	Unit-4: Question 7 or 8	16
			9 & 10	Unit-5: Question 9 or 10	16
			11	Laboratory Component (Compulsory)	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301T	**ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*(Professional Core - 1)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.B.C.Udayashankar			

UNIT - I	**8 Hrs**
Slabs: 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.	
UNIT - II	**8 Hrs**
Grid floors and Flat slabs: General features, Rigorous and approximate methods of analysis, Design and detailing of grid floors. Design and detailing of flat slabs including unbalanced column moments.	
UNIT - III	**9 Hrs**
Elevated Water tanks: Design and detailing of overhead water tanks with circular shell shaped and cylindrical shaft.	
UNIT - IV	**9 Hrs**
Silos (circular) and bunkers: analysis, design and detailing of side walls, hopper bottoms.(Expression for Airy's and Jansen theory need to be supplied)	
UNIT - V	**8 Hrs**
Deep Beams: General features, parameters influencing design, strut and tie model, flexible bending stress. Design of brackets and corbels: Introduction,load transfer, Dimensioning , Analysis and design	

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

CO1	:	Apply principles of RCC to design slabs and walls
CO2	:	Estimate the loads to assess critical bending moments, shear forces and torsion
CO3	:	Design RCC walls and slabs subjected to various loading combinations
CO4	:	Detailing of reinforcement for RCC structures

Reference Books

1. Reinforced Concrete Structures, R Park and T Paulay, 2nd Edition, 2013. John Wiley & Sons, USA,ISBN:9780471659174.

2. Design of Reinforced concrete Structures, S. Ramamrutham, 2nd Edition, 2015 Dhanpat Rai Publishing Co
Pvt Ltd., ISBN 978-9384559984.2.

3. Advanced Reinforced Concrete Design, P. C. Varghese, PHI Learning Pvt. Ltd., 2nd Edition, 2009, ISBN:
812032787X, 9788120327870.3.

4. Advanced Reinforced concrete structures ,Dr N.Krishna Raju 2018, CBS Publishers and distributors,ISBN:81239-1225-0.4.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301L	**ANALYSIS AND DESIGN OF STRUCTURES LAB -1**	-CIE Marks	:	50
Credits L-T-P	:	1 - 0 - 1		SEE Marks	:	50
Hours	:	14L + 28P	*(Coding / Skill Laboratory)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof.Ashwin Thammiah/Prof.Shriti Badami			
Content						**28 Hrs**
1. Analysis of a Plane Truss 2. Analysis of a Space Truss 3. Analysis of Continuous Beams 4. Analysis of Plane Fr 5. Analysis of Space Frames 6. Analysis of Retaining Walls 7. Analysis of Grid Plates 8. Analysis and Design of Multi-Storey RCC Building 9. Analysis and Design of Multi-Sto 11. Analysis and Design of Buildings subjected to Earthquake Loads (Response Spectrum) 12. Analysis and Design of Buildings subjected to Wind Loads						
Course Outcomes: After going through this course the student will be able to:						
CO1	:	Apply knowledge of Structural Analysis and Design to model and analyze structures on Staad Pro.				
CO2	:	Analyze a building component subjected to various loads using Staad Pro.				
CO3	:	Design various building components as per Codal Provisions using Staad Pro.				
CO4	:	Distinguish between the various static and dynamics types of analyses performed on structures				
Reference Books						
1. T.S.Sarma, Staad Pro V8i for Beginners: With Indian Examples, 1st edition, Notion Press, 2014, ISBN 978-9384381684						
2. Sham Tickoo, Exploring Bentley STAAD.Pro CONNECT Edition , 1st Edition, Cadcim Technologies, 2018, ISBN 978-1942689744						
3. IS 1893: 2016 (PART 1), CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES, SIXTH REVISION, BUREAU OF INDIAN STANDARDS, 2016						
4. IS 875: 2015 (PART 3), DESIGN LOADS(OTHER THAN EARTHQUAKE) FOR BUILDINGS AND STRUCTURES, THIRD REVISION, BUREAU OF INDIAN STANDARDS, 2015						

Scheme of Continuous Internal Evaluation (CIE- Laboratory) : Only LAB Course 30 + 10 + 10 = 50. The Laboratory session is held every week as per the timetable and the performance of the student is evaluated in every session. The average of marks over number of experiments conducted over the weeks is considered for 30 Marks i.e (Lab Report, Observation & Analysis). The students are encouraged to implement additional innovative experiments in the lab (10 marks). At the end of the semester a test is conducted for 10 Marks (Lab Test). This
adds to 50 Marks.

Scheme of Semester End Examination (SEE- Laboratory) : Only LAB Course 40 + 10 =50.
Students will be evaluated for Write-up, Experimental Setup, Experiment Conduction with Results, Analysis & Discussions for 40
Marks and Viva will be conducted for 10 Marks adding to 50 Marks.

Only LAB Courses with 50 Marks

RUBRIC FOR CIE			RUBRIC FOR SEE	
Sl.No	Content	Marks	Content	Marks
1	Write Up, Setup, Conduction Results, Analysis & Discussions	30	1. Write Up, Setup, Conduction 2. Results, Analysis & Discussions	40
2	Innovative Experiment/Concept Design & Implementation	10		
3	Laboratory Internal	10	Viva Voce	10
	Total Marks	50	Total Marks	50

SEMESTER: I						
Course Code	:	MST301A1	**FINITE ELEMENT METHOD OF ANALYSIS**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.T.Raghavendra			

UNIT - I **9 Hrs**

Basic concepts of elasticity – kinematics and static variables for various types of structural problems – approximate method of structural analysis – Rayleigh-Ritz method – Difference between Finite Difference Method and Finite Element Method – variational method and minimization of energy approach for element formulation – principles of finite element method – advantages & disadvantages – finite element procedure – finite elements
both first and second order elements used for one, two and three dimensional problems.

UNIT - II **8 Hrs**

Nodal displacement parameters – convergence criteria – compatibility requirements – geometric invariance –
shape function – polynomial form of displacement function – generalized and natural coordinates – Lagrangian interpolation function.

UNIT - III **9 Hrs**

Serendipity and Lagrangian family of elements – shape functions for one, two and three dimensional first and second order elements – Hermite shape function for beam formulation – Numerical problems to interpolate nodal variables using shape function. Formulation of one-dimensional bar element, two- and three-noded elements
using Lagrangian shape function ¬ – numerical analysis of simple bars and plane trusses

UNIT - IV **8 Hrs**

Two noded beam element formulation using Hermite shape function – Jacobian transformation matrix – strain-displacement matrix – stiffness matrix – consistent load vector – Gauss quadrature for numerical integration – numerical analysis of simple beams. Iso-parametric elements – sub-parametric and
super-parametric elements – Formulation of two-dimensional three-noded triangular (CST) element

UNIT - V **8 Hrs**

Formulation of four-noded quadrilateral element, and its application to plane stress, plane strain and axis-symmetric problems – application of Gauss quadrature for numerical integration – Numerical problems. Element aspect ratio – mesh refinement vs. higher order elements – numbering of nodes to minimize bandwidth – static condensation technique – introduction to non-linear analysis – geometric and material non-linearity with examples.

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

CO1	:	Apply the principles of approximate numerical methods and identify non-linearity of structures
CO2	:	Use Finite Element Method for formulation of stiffness matrix and load vector for bar, beam, truss, three noded and four noded elements
CO3	:	Solve continuum problems using finite element analysis
CO4	:	Illustrate the concept of condensation and minimization of matrix bandwidth, gauss quadrature and mesh refinement

Reference Books

1. CS Krishnamoorthy, Finite Element Analysis – Theory and Programming, 2nd edition, McGraw Hill Education,
2017, ISBN: 978-0074622100

2. RD Cook, DS Malkus, ME Plesha and RJ Witt, Concepts and Applications of Finite Elements Analysis, Fourth
edition, Wiley, 2007, ISBN: 978-8126513369

3. OC Zienkiewicz, RL Taylor and JZ Zhu, The Finite Element Method: Its Basis and Fundamentals, 7th edition,
Butterworth-Heinemann, 2013, ASIN: B00FH1FRXM

4. KJ Bathe, Finite Element Procedures, Second edition, Klaus-Jürgen Bathe, 2014, ISBN: 978-0979004957

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full
question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301A2	**FORENSIC ENGINEERING AND REHABILITATION OF STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3- 0- 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.B.G.Anandkumar			

UNIT - I **8 Hrs**

Deterioration: Introduction, Cause of Deterioration of Concrete Structures, Diagnostic Methods and Analysis, Preliminary Investigation, Experimental Investigations Using NDT, Load Testing, Corrosion Mapping, Core
Drilling, Other Instrumental Methods.

UNIT - II **9 Hrs**

Influence on serviceability and durability: Effects Due To Climate, Temperature, Chemicals, Wear and Erosion, Design and Construction Errors, Corrosion Mechanism, Effects Of Cover, Thickness and Cracking, Methods of
Corrosion Protection, Corrosion Inhibitors, Corrosion Resistant Steels, Coatings, Cathodic Protection.

UNIT - III **8 Hrs**

Maintenance and repair strategies: Definitions, Maintenance, Repair And Rehabilitation, Facets of maintenance, Importance Of Maintenance, Preventive Measures on Various Aspects, Inspection, Assessment Procedure for Evaluating a Damaged Structures, Causes of Deterioration, Testing Techniques.

UNIT - IV **8 Hrs**

Techniques Of Repair: Rust Eliminators, Polymers Coating for Rebar during Repair, Foamed Concrete,. Mortar and Dry Pack, Gunite and Shotcrete, Epoxy Injection Mortar, Repair for Cracks, Shoring and
Underpinning.

UNIT - V **9 Hrs**

Repair to Structures: Repairs to Overcome Low Member Strength Deflection, Cracking Chemical Disruption, Weathering, Wear Fire, Leakage, Marine Exposure, Engineered Demolition Techniques for Dilapidated Structure,
Case Studies.

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

CO1	:	Identify the causes of failure in concrete structures
CO2	:	Analyze failures in concrete structures
CO3	:	Evaluate causes for failures in deteriorated concrete structures
CO4	:	Develop simple and comprehensive solutions to rehabilitate deteriorated structures

Reference Books

1. Repair of concrete structures ,R T Allen and SC Edwards, Blakie and Sons ISBN 1352, 2009

2. Learning for failure from deficiencies in design construction and service , Raikar R.N, 2008, R & D Center
(SDCPL),.ISBN:12657-764-853-2318

3. Rehabilitation of Concrete Structures, B Vedivelli, ,2013, Standard publishers and distributors, ISBN:
978-8180141102

4. Distress and Repair of Concrete Structures, Norb Dellate Failure,Nov9,2009,Ist Edition,Woodhead Publishing
Series in Civil and Structural Engineering,Woodhead Publishing.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full
question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301A3	**HIGH RISE STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			**Prof.Ashwin Thammaiah**			

UNIT - I	**8 Hrs**
Introduction to tall structures, Historical Background, Review of High-Rise Architecture, Functional Requirements, Definition of Tall Buildings, Lateral Load Design Philosophy, Concept of Premium for Height, Relative Structural Cost, Factors for Reduction in the Weight of Structural Frame	
UNIT - II	**8 Hrs**
Structural Forms: Braced Frames, Rigid Frames, Infilled Frames, Shear Walls, Coupled Shear Walls. Classification, types, behaviour, advantages, disadvantages for all the above mentioned systems.	
UNIT - III	**8 Hrs**
Structural Forms: Tubular structures, Core structures, Outrigger structures. Classification, types, behaviour, advantages, disadvantages for all the above mentioned systems.	
UNIT - IV	**9 Hrs**
Modeling for Analysis, Assumptions, Approaches, High Rise Behaviour, Modelling for Approximate Analysis, Modelling for Accurate Analysis, Reduction Techniques.	
UNIT - V	**9 Hrs**
Case Studies: Empire State Building -New York City, Petronas Towers - Malaysia, Burj Al Arab - Dubai, Burj Khalifa - Dubai, Shanghai Tower - China. And Future of Tall Buildings	

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

CO1	:	Understand the importance and relevance of high rise structures in modern construction.
CO2	:	Illustrate the various structural forms using in high rise structures
CO3	:	Apply modelling techniques to predict the behaviour of high rise structures
CO4	:	Compare and infer the challenges in design of High Rise Buildings of real life examples.

Reference Books

1. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 1988. ISBN-13 : 978-0070628786

2. Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons,
Inc., 2005. ISBN-13 : 978-0471512370

3. Beedle.L.S., “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986. ISBN-13 : 978-0442215996

4. Lin T.Y and Stotes Burry D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988. ISBN-13 : 978-0471085386

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301B1	**ADVANCED STRUCTURAL ANALYSIS**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.M.V Renuka Devi			

UNIT - I	**8 Hrs**
Curved Beams Curved beams, Introduction, assumptions, derivation of WINKLER BACH equation, Radius to the neutral surface of simple geometric figures, Limitation, Stress distribution in open curved members such as Hooks and chain links, Stress distribution in closed rings and chain links. Deformations of open and closed rings.	
UNIT - II	**9 Hrs**
Beams on Elastic Foundations Governing differential equation for elastic line, Interpretation of constants, Infinite beam with point load, moment & UDL with problems. Semi-infinite beams with point load and moment UDL with problems over fixed and hinged support conditions.	
UNIT - III	**8 Hrs**
Shear Centre Concept of shear center in torsion induced bending of beams, expression to the Shear Centre for Symmetrical and Unsymmetrical Sections, Derivation of shear centre for angles, channel, semicircular and built-up sections with numerical problems	
UNIT - IV	**8 Hrs**
Unsymmetrical Bending (Asymmetrical Bending) Theory behind unsymmetrical bending, Assumptions, obtaining the stresses in beams, simply supported and cantilever unsymmetrical beams subjected to inclined loading, Deflections of unsymmetrical simply supported and cantilever beams with numerical problems.	
UNIT - V	**9 Hrs**
Buckling of Non Prismatic Columns and Beam-Column Principle behind Euler's theory of buckling, Governing differential equation applied to buckling of columns and evaluation of constants for various boundary conditions, Obtaining the characteristic equation for the buckling load of non-prismatic compound columns, Analysis of Beam- column, conceptual theory of magnification stresses and deformations subjected to axial and different types of lateral loads with numerical problems.	

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

CO1	:	Explain concepts of stresses, moments, deformation and pressure in beams and columns
CO2	:	Examine the influence of stresses, moments, deformation and pressure on beams and columns
CO3	:	Analyze beams on elastic foundation, beam column and unsymmetrical bending and Shear centre of beams
CO4	:	Evaluate stresses, moments, deformation and pressure in beams and columns

Reference Books

1. Srinath L.S (2000), Advanced Solid Mechanics TMH., New Delhi, ISBN-13 978-81-265-1336-9. 3

2. 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

3. Den Hartog, (1952), Advanced Strength of Materials, McGraw Hill, N.Y.,ISBN:9780486654072

4. 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): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based
seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301B2	**MECHANICS OF DEFORMABLE BODIES**	CIE Marks	:	100
Credits L-T-P	:	3- 0- 0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.K.Madhavi			

UNIT - I	**9 Hrs**
Analysis of stress: Introduction, stress, components of stress at a point in Cartesian coordinates (2D & 3D), plane stress problems, equilibrium equations, stresses on inclined plane, stress transformation, principal stresses, maximum shear stress, stress invariants hydrostatic and deviatoric stresses, octahedral stresses, boundary conditions. Stress components (2D & 3D) in polar coordinates, equilibrium equations.	
UNIT - II	**8 Hrs**
Analysis of strain: Strain, components of strain at a point in Cartesian coordinate's, strain transformation, principal strains,Maximum shear strain and octahedral strain. Strain Components in Polar Coordinate System.	
UNIT - III	**8 Hrs**
Stress strain relations and compatibility equations: Generalized Hooke's law, constitutive equations, lame's constants, compliance matrix, Saint vaint's principle of superposition, compatibility equations for 3 dimensional elements in Cartesian coordinates, compatibility equations for plane stress and plane strain problems in terms of stress components, Naviers equations, boundary value problem, stress compatibility equations in polar coordinate system. Constitutive Relations in Polar Coordinate System.	
UNIT - IV	**8 Hrs**
Two - Dimensional Problems in Cartesian and Polar Coordinates: Biharmonic equation in Cartesian coordinates, Airy's stress functions, polynomials, as stress functions. Stress functions for plane stress and plane strain, bending of cantilever and simply supported beams. Biharmonic equations in polar coordinates. Axisymmetric problems, thick walled cylinder subjected to internal and external pressures, Effect of circular hole on stress distribution.	
UNIT-V	**9 Hrs**
Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes. Introduction to Plasticity: Stress – strain diagram in simpletension, perfectly elastic, Rigid – Perfectly plastic, Linear work – hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials, Failure theories , Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, stress – space representation of yield criteria through Westergard stress space.	

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

CO1	:	Explain the basic principles of Elasticity and plasticity
CO2	:	Analyse the behavior of objects under two and three dimensional state of stress
CO3	:	Evaluate the stress and strain in two and three dimensional problems.
CO4	:	Formulate equations governing the behavior of two and three dimensional solids.

Reference Books

1.Timoshenko & Goodier, Theory of Elasticity, 3rd edition, Tata McGraw-Hill Publishing Company,ISBN-10:
0070702608, ISBN-13: 978-0070070268

2.Advanced Mechanics of Solids, Srinath L.S, 3rd edition,2010, TataMcGraw Hill Publishing company ISBN-10:
0070858055 ISBN-13: 978-0070858053

3.T G Sitaram and L Govindaraju,Elasticity for Engineers,1st edition,2016, I K International Pvt Ltd, ISBN –
978-93-85909-34-4

4.Chakrabarthy.T, Theory of Plasticity, 3rd Edition, Tata Mc.Graw Hill Book Co,ISBN-10:9380931719 ISBN-13:
9789380931715.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full
question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I						
Course Code	:	MST301B3	**DESIGN OF MASONARY STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3- 0- 0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.Somanath Basutkar			

UNIT - I	**8 Hrs**
Introduction, Masonry units, materials and types: History of masonry, historical buildings, Masonry arches, domes and vaults: Components, classification and construction procedure	
UNIT - II	**8 Hrs**
Characteristics of masonry constituents: Types of masonry units such as stone, bricks, concrete blocks, clay blocks and stabilized mud blocks. Properties of masonry units like strength, modulus of elasticity and water absorption. Masonry mortars – Classification and properties of mortars, selection of mortars	
UNIT - III	**8 Hrs**
Strength of Masonry in Compression: Behaviour of Masonry under compression, strength and elastic properties, factors influencing of compressive strength masonry, Effects of slenderness and eccentricity, water absorption, curing, ageing and workmanship on compressive strength. Prediction of strength of masonry in Indian context	
UNIT - IV	**9 Hrs**
Shear and Flexure Behavior of Masonry : Bond between masonry unit and mortar, test methods for determining flexural and shear bond strengths, test procedures for evaluating flexural and shear strength, factors affecting bond strength, effect of bond strength on compressive strength, flexure and shear strength of masonry. Concept of Earthquake resistant masonry buildings	
UNIT - V	**9 Hrs**
Design of load bearing masonry buildings: concept of basic compressive stress, Permissible compressive stress, reduction factors. Increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions	

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

CO1	:	Choose appropriate masonry unit and mortar mixes for masonry construction
CO2	:	Distinguish wide range of materials for their suitability to arrive at feasible and optimal solutions for masonry constructions
CO3	:	Appraise knowledge of structural masonry for advanced research and construction procedures
CO4	:	Design masonry buildings for sustainable development

Reference Books

1. Structural Masonry ,Hendry A.W, 2nd edition,Palgrave Macmillan, Macmillan Education Ltd. ,ISBN 10:
0333733096 ISBN 13:9780333733097

2. Masonry structures- Behavior and Design, Robert G Drysdale, Ahmad A Hamid, 3rd edition ,2008 Boulder,
CO : Masonry Society, , ISBN 1929081332 9781929081332

3. Structural Masonry, Jagadish K S, 2015, I K International Publishing House Pvt Ltd, ISBN – 10: 9384588660,
ISBN 13: 978-9384588663

4. Code Books:
IS 1905: 1987, Indian standard Specification for Code of Practice for Structural Use of Unreinforced

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full
question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	**MIM431T**	**RESEARCH METHODOLOGY**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Common Course to all M.Tech Programs*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Rajeswara Rao K V S			

UNIT - I	8 Hrs
Research Problem: Problem Solving – General Problem Solving, Logical Approach, Soft System Approach, Creative Approach, Group Problem Solving Techniques for Idea Generation. Formulation of Research Problems – Approaches to Research Problem, Exploration for Problem Identification, Hypothesis Generation and Formulation of the problem.	
UNIT - II	9 Hrs
Research Design: Experimental Design – Principles of Experiment, Laboratory Experiment, Experimental Design, Quasi Experimental Design, Action. Research, Validity and Reliability of Experiment and Quasi Experiments. Ex Post Facto Research – Exploratory Research, Historical Research, Descriptive Research, Field Studies, Survey Research, Qualitative Research Methods.	
UNIT - III	8 Hrs
Research Design for Data Acquisition: Measurement Design – Primary types of Measurement scales, Validity and Reliability Measurement, Sample Design – Non-Probability Sampling, Probability Sampling. Data Collection Procedures – Sources of secondary data, Primary data collection methods, Validity and Reliability of data collection procedures.	
UNIT - IV	9 Hrs
Data Analysis: Exploratory Data Analysis, Statistical Estimation, Hypothesis Testing, Parametric Tests, Non-Parametric Tests, Multiple Regression, Factor Analysis, Cluster Analysis	
UNIT - V	8 Hrs
Research Proposal: Purpose, Types, Development of Proposal, Evaluation of Research Proposal. Report Writing: Pre-writing consideration, Format of Reporting, Briefing, Best practices for Journal writing.	

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

CO1	:	Recognize the principles and concepts of research types, data types and analysis procedures.
CO2	:	Apply appropriate method for data collection and analyze the data using statistical principles.
CO3	:	Express research output in a structured report as per the technical and ethical standards.
CO4	:	Develop a research design for the given engineering and management problem context.

Reference Books:

1. Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Integration of Principles, Methods and Techniques, 17th Impression, Pearson India Education Services Pvt. Ltd, 2018. ISBN: 978-81-7758-563-6

2. William M. K. Trochim, James P. Donnelly, The Research Methods Knowledge Base, 3rd Edition, Atomic
Dog Publishing, 2006, ISBN: 978-1592602919

3. Kothari C.R., Research Methodology Methods and Techniques, 4th Edition, New Age International
Publishers, 2019, ISBN: 978-93-86649-22-5.

4. Levin, R.I. and Rubin, D.S., Statistics for Management, 8th Edition, Pearson Education: New Delhi,
2017, ISBN-13- 978-8184957495.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based
seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MST331I	**STRUCTURAL DYNAMICS**	CIE Marks	:	100
Credits L-T-P	:	3-0-1	*(Theory & Practice)*	SEE Marks	:	100
Hours	:	42L + 28P	*(Professional Core - 3)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.M.V.Renuka Devi			

UNIT - I **8 Hrs**

Introduction: Introduction to dynamic problems of Civil Engineering, Concept of degrees of freedom, D'Alemberts principle, Principle of virtual displacement and energy, Single degree of freedom systems, Examples of Single
degree of freedom systems in Engineering, Free vibration of damped and undamped systems.

UNIT - II **9 Hrs**

Single degree of freedom systems subjected to sinusoidal loading, Resonance and its resonance diagram – support motion, Vibration isolation, transmissibility, Methods of damping measurements, Response of Single degree of freedom systems to arbitrary excitation, Duhamel integral solution, Response to suddenly applied load
and triangular pulse loading, Principles of vibration measuring instruments

UNIT - III **8 Hrs**

Dynamics of multi-Degree of freedom system, Natural Frequency and normal modes, Orthogonality of modal vectors, Shear building model without damping and with proportional damping, Approximate methods of frequency analysis, Rayleigh's method and matrix iteration methods.

UNIT - IV **8 Hrs**

Concepts of Response Spectrum, Response of shear building with proportion damping, Superposition of normal modes, Example of a 3-storeyed frame subjected to ground motion

UNIT - V **9 Hrs**

Continuous systems, Flexural vibration of beams, Simply supported and cantilever beams, Longitudinal vibrations of bars, Longitudinal waves in bars, Waves and vibration response of simply supported beams under uniformly distributed triangular pulse loading, Matrix formulation of beams with lumped masses.

LABORATORY
28 Hrs

1. Determination of fundamental frequency and mode shape for SDOF systems, analytically, experimentally, and numerically.
2. Determination of fundamental frequencies and mode shapes for 2-DOF systems, analytically, experimentally, and numerically.
3. Determination of fundamental frequencies and mode shapes for 3-DOF systems, analytically, experimentally, and numerically.
4. Determination of fundamental frequencies and mode shapes for continuous cantilever systems, analytically, experimentally, and numerically.
5. Experimental and analytical studies on MDOFs with and without the effect of walls.
6. Experimental and analytical studies on MDOF's with and without tuned mass dampers.
7. Experimental and analytical studies on SDOF's with and without torsional irregularity.
8. Experimental studies on the effect of water level of dynamic behaviour of water tanks subjected to harmonic excitation.
9. Experimental studies on MDOFs with and without base isolators. 10. Analytical and numerical modelling of a
10-DOF and determination of all mode shapes and frequencies.

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

CO1	:	Idealize and model simple structures as discrete and continuous vibratory system.
CO2	:	Develop equations of motion for discrete and continuous vibratory system.

CO3	:	Evaluate the frequencies for various discrete and continuous vibratory system.
CO4	:	Assess the dynamic response of various two and three dimensional models analytically, experimentally and numerically.

Reference Books

1. Structural Dynamics : Vibrations and Systems, Madhujit Mukophadhyay, Edition: 01, 2008,Publisher: ANE
Books ISBN: 9788180520907, 8180520900

2. Structural Dynamics: Theory and Computation, 2nd Edition, Mario Paz, CBS Publisher ISBN: 9788123909783, 8123909780

3. Dynamics of Structures, R,W. Clough and J. Penzien, McGraw – Hill Education, 2nd revised Edition, 1993,
ISBN -10: 0071132414, ISBN -13: 978-0071132411

4. Theory of vibration with applications, Willaim Thomson; 4th edition, 1996, CRC Press ISBN -10: 0748743804,
ISBN -13: 978-0748743803.

Scheme of Continuous Internal Evaluation (CIE): 10 + 30 + 30 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The average of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 30 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (10), Video based seminar
/presentation /demonstration (20) adding upto 30 marks.

Laboratory: Conduction of laboratory exercises, Lab report & observation & analysis (30 Marks), Lab Test (10 Marks) & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks. The final marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks: Each unit consists of TWO Questions of 16
Marks each. Answer FIVE full questions selecting one from each unit (from 1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.

Rubric for CIE & SEE for Integrated Theory courses with Laboratory

RUBRIC of CIE			RUBRIC of SEE	
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**
1	Quizzes - Q1 & Q2	10	Each unit consists of TWO questions of 16 Marks each. Answe full questions selecting ONE from each unit (1 to 5). Question No. 11 is compulsory (Laboratory component) for 20	
2	Tests - T1 & T2	30		
3	Experiential Learning - EL1 & EL2	30	1 & 2	Unit-1: Question 1 or 2
4	Laboratory	30	3 & 4	Unit-2: Question 3 or 4
	Total Marks	100	5 & 6	Unit-3: Question 5 or 6
NO SEE for Laboratory			7 & 8	Unit-4: Question 7 or 8
			9 & 10	Unit-5: Question 9 or 10
			11	Laboratory Component (Compulsory)
				Total Marks

SEMESTER: II						
Course Code	:	MST331T	**ADVANCED DESIGN OF STEEL STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*(Professional Core - 4)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr.Ravindra.R				

UNIT - I	**9 Hrs**
Components of industrial structure, assessment of dead loads, live loads and wind loads on a mill bent frame. Analysis and design of knee brace, column and purlins.	
UNIT - II	**9 Hrs**
Analysis and design of gantry girder subjected to single and two wheel loads, Splices for bending moment and shear force.	
UNIT - III	**8 Hrs**
Components self supporting steel chimneys, assessment of wind loads, moments at base, assessment of seismic loads. Analysis and Design of self supporting circular steel chimneys.	
UNIT - IV	**8 Hrs**
Forms of light guage sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light guage sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength. Design of compression and tension members of cold formed light guage sections, Design of flexural members (Laterally restrained / laterally unrestrained).	
UNIT - V	**8 Hrs**
Design of open web structures(triangular and rectangular),concept of pre-engineered buildings	

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

CO1	:	Identify and compute the design loads on different types of steel structures.
CO2	:	Analyze the various steel components for different loads acting on them.
CO3	:	Design various types of steel structural components using provisions of standards, codes of practice for ethical design of steel components and develop professional competencies.
CO4	:	Propose design solution of industrial steel structures at component and system level.

Reference Books

1. Bureau of Indian Standards, IS800-2007, IS875-1987, IS-801-1975. Steel Tables, SP 6 (1) – 1984, IS6533(Part 1 and 2),IS1893(part 4):2005.

2. Design of Steel Structures, N.Subramanian, Oxford University Press,2011, ISBN: 9780198068815.

3. Design of Steel Structures, Ramchandra and Virendra Gehlot ,Vol 1 and Vol.2, Scientific Publishers, Jodhpur, 2010.

4. Limit State Design of Steel Structures, Duggal S K,TMH publication, New Delhi, ISBN (13):978-0-07-070023-9. 2009

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based
seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MST331C1	**DESIGN OF CONCRETE BRIDGES**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Er.B.V.Nagesh/Dr.B.C.Udayashankar			

UNIT - I	**8 Hrs**
Classification of Bridges, IRC Loading and vehicular load combinations Impact factor and congestion factors. Partial safety factor for – verification of equilibrium, Structural strength and serviceability limit state. Design of RCC solid slab bridge.	
UNIT - II	**9 Hrs**
Design of Box culverts. RCC T-Beam Girder & Slab Bridge :Transverse Analysis and Design, Longitudinal Analysis - Courbon method Ultimate Design for Long bending and Shear and Limit state of serviceability	
UNIT - III	**9 Hrs**
Grillage Analysis for T-Beam Girder super structure . Design of post tensioned PSC Girders - losses in presstressing , cable profile, end block design and ultimate strength design .	
UNIT - IV	**8 Hrs**
Design of composite Girder Bridge -- Limit state of strength and Servicibility . Types of bearings and expansion joints .	
UNIT - V	**8 Hrs**
Bridge Sub Structure And Foundation: Calculation of various forces on Substructure & Foundation as Per IRC, Methodology for design of substructure and foundation, Design of Substructure for simply supported Girder Bridge.	

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

CO1	:	Explain the components of a Highway bridges and specifications.
CO2	:	Analyse the IRC loading conditions for the design of bridges.
CO3	:	Design Aspects of RCC , PSC and Composite Bridge Super structure and understanding the types of Bridge Bearings and Expansion joints
CO4	:	Design Bridge Substructure by analysing the forces acting on it.

Reference Books

1.Concrete Bridge Practice: Analysis, Design and Economics , V. K. Raina ; Publisher, Tata McGraw-Hill, 1991 ;
ISBN, 0074603086, 9780074603086

2. ,Bridge Engineering, Ponnuswamy,McGraw-Hill Education (India) Pvt Limited, 2007,ISBN 0070656959,
9780070656956

3 Bridge Deck Behaviour ,Hambly EC, December 12, 2019 by CRC Press,ISBN 9780367863425

4.Bridge Super Structure, N.Rajgopalan ,Narosa Publishing House Pvt. Ltd., New Delhi, 2013,ISBN 13: 9788173196478. IRC CODES : IRC -6, IRC-112, IRC -24 , IRC -78

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MST331C2	**DESIGN FOR SAFETY**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Er.Govind Ramesh/Dr.B.G.Anand Kumar			

UNIT - I	**9 Hrs**
PRINCIPLES-Mission Statement: conceptulization of requirements- result chain analysis-validation of mission statement-periodic testing and confirmation.Interacting in the Eco-System-understanding stakeholder participation-maximum human impact due to safety-feedback and correction at the origin of impact- incorporating best practice- situation monitor and correction for design for safety.Dealing with Jumbled Flow- types of process flows- continous flow- intermittent flow-jumbled flow.Role Efficacy for Civil Engineers- personal effectiveness- MBTI- Role Play and Integration	
UNIT - II	**9 Hrs**
TRAINING-AISC Design Guide-10 on lateral stability- lateral stability during lifts and shifts-sequential stability- stiffness vs deformations- bifurcation theory and instability theory.Anthropological Study-Hoffstede Cultural Studies- Construction labour productivity-migrant workers-Hygienic and Core Motivation- Statutory Requirements, Adult Teaching.Dealing with Jumbled Flow- types of process flows- continous flow- intermittent flow-jumbled flow.Role Efficacy for Civil Engineers- personal effectiveness- MBTI- Role Play and Integration	
UNIT - III	**8 Hrs**
RISK MANAGEMENT-Uncertainty-Risk attitudes, Monte Carlo Simulations or equivalent methods.Prevention Methods- prevention through design.Quantitative Assessments-decision trees, root cause analysis, lean construction methods.Qualitative Assessments- S curves	
UNIT - IV	**8 Hrs**
BIASES & HUERISTICS-Individual-availability- representative-anchoring-confirmation Biases.Team-Group Thinking-Moses Effect-CulturalConfirmity-Risky Shift-Cautios Shift.Organisational- Cultural-Behaviour and Structure.Matrix Organization-types and efficacy.	
UNIT - V	**8 Hrs**
CASE STUDIES-PreMortem Techniques- Complete premortem methods,Individual Case Studies,Group Case Studies,Life Cycle Process- intiation- planning- exectuion and maintainance	

Course Outcomes:

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

CO1	:	Conceptualization of Safety in Design
CO2	:	Knoweldge Stacking for Safety in Design
CO3	:	Understanding & Managing Unknowns
CO4	:	Judgement in Decision Making

Reference Books

1. Bazerman,'Judgements', Fifth Edition, Wiley, 2002, ISBN 0-471-39887-X
2. Harold Kertzner,'Project Management',12th Edition,2017, Wiley, ISBN.-978-1-119-16535-4
3.OSHA,Steel Erection, SubPart 1926, OSHA
4.AISC, Structural Steel Buildings Specifications, 2021, AISC

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MST331C3	**PRECAST CONCRETE STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Er.Ganapati M G /Dr.B.G.Anand Kumar			

UNIT - I	**8 Hrs**
Concept of precast, precast products, standardization, precast accessories, types of precast constructions, methodologies, equipments and machineries, economy of prefabrication, Planning for Components of prefabricated structure, Disuniting of structures.	
UNIT - II	**9 Hrs**
Choice of production setup, Manufacturing methods, Stationary and mobile production, Planning of production setup, Storage of precast elements, Dimensional tolerances, Acceleration of concrete hardening. Equipments for hoisting and erection Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads. Logistics and transportation.	
UNIT - III	**8 Hrs**
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	**9 Hrs**
Roof and floor panels, ribbed floor panels, wall panels, footings, Joints for different structural Connections, Effective sealing of joints for water proofing, Provisions for non-structural fastenings, Expansion joints in pre-cast construction. Designing and detailing of precast unit for factory structures, Purlins, Principal rafters, roof trusses, lattice girders, gable frames, Single span single storeyed frames, Single storeyed buildings, slabs, beams and columns. 3D Precast elements, 3D printing of elements, Prestressed precast slabs for roads	
UNIT - V	**8 Hrs**
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.	

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

CO1	:	Demonstrate the precast concrete concepts, types of precast construction and its advantages
CO2	:	Identify precast plant set up for production and storage systems, plan logistics of precast elements
CO3	:	Examine different types of pre-cast elements.
CO4	:	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. PCI Journal– Proposed Design Requirements for Precast Concrete ,Prestressed Concrete Institute , PCI Committee on Building Code and PCI Technical Activities Committee.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			*RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MST331C4	**SUSTAINABLE CONSTRUCTION PRACTICES**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.Yoganand/Dr.Somanath Basutkar			

UNIT - I	**9 Hrs**
Materials and resources. Mortars and concrete. Environmental considerations Problem of sand, aggregate, cement and steel - Carbon emission – importance of local resources. Alternatives cement and plasters. Utilization of industrial waste products. Construction and demolition waste and their utilization. Role of Timber and Bamboo in low energy alternatives.	
UNIT - II	**8 Hrs**
Environment degradation due to exploitation of iron ore, limestone in forested areas. Importance of cement and steel conserving buildings. Replacement of fossil fuels by renewable energy. Foundations Energy efficient concepts for foundations.	
UNIT - III	**9 Hrs**
Wall construction Bricks and blocks, strength of masonry and its design, sample design of a 4 and 5 storied masonry building, other methods of wall construction.	
UNIT - IV	**8 Hrs**
Precast Components for Buildings Pre cast elements for lintels, sunshades and roofing systems. Use of ferro-cement and ferro-concrete elements.	
UNIT - V	**8 Hrs**
Roof construction In-situ roofs – Filler Slabs, Beam and Panel roofing – Jack arch roof. Curved Panel roofs – Ventilated roofs. Ferrocement Precast roofs, Masonry shell roofs – Cylindrical and domical roofs, shallow dome roofs. Weatherproofing of roofs.	

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

CO1	:	Apply concepts of sustainable technology for design and construction of various building components.
CO2	:	Examine the suitability of sustainable materials in building components.
CO3	:	Select the best possible sustainable technology based on in-situ conditions.
CO4	:	Justify the chosen sustainable technologies with suitable design.

Reference Books

K.S. Jagadish, Sustainable Building Technology, I K International Publishing House Pvt. Ltd ISBN-10: 9386768208, ISBN-13: 978-9386768209 30 March 2019

K.S. Jagadish, Structural Masonry, I K International Publishing House Pvt. Ltd, ISBN-10: 9384588660,
ISBN-13: 978-9384588663, 30 November 2015

K. S. Jagadish, B. V. Venkatarama Reddy and K. S. Nanjunda Rao, Alternative Building Materials and Technologies. New Age International Publishers, New Delhi, 2nd Edition, 2016.

K. S. JAGADISH and PANKAJ MODI, Domes and Vaults of South India, Indian National Academy of Engineering,
New Delhi, 2011

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			*RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MBT331G	**BIOINSPIRED ENGINEERING**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hr
Faculty Coordinator:			Dr Nagashree Rao and Dr Ashwani Sharma			

UNIT - I	**8 Hrs**
Introduction to Bio-inspired Engineering: Macromolecules, Stem cells; types and applications. Synthetic Biology; Bottom-up' and 'top-down' engineering approaches. Synthetic/ artificial life. Biological Clock, Genetic Algorithms.	
UNIT - II	**9 Hrs**
Principles of bioinspired materials: Biological and synthetic materials, Self-assembly, hierarchy and evolution. Biopolymers, Bio-steel, Bio-composites, multi-functional biological materials. Thermal Properties. Antireflection and photo-thermal biomaterials, Microfluidics in biology, Invasive and non-invasive thermal detection inspired by skin	
UNIT - III	**9 Hrs**
Lessons from Nature:Bioinspired Materials and mechanism: Firefly-Bioluminescence, Cockleburs –Velcro, Lotus leaf -Self-cleaning materials, Gecko - Gecko tape, Whale fins - Turbine blades, Box Fish / Bone - Bionic car, Shark skin - Friction reducing swim suits, Kingfisher beak - Bullet train, Coral - Calera cement, Forest floor / Ecosystem functioning - Flooring tiles, Morpho butterfly- Structural color, Namib beetle- Water collecting, Termite mound passive cooling, Birds/Insects- flights/ aerodynamics, Mosquito inspired micro needle.	
UNIT - IV	**8 Hrs**
Biomedical Inspiration-Concept and applications: Organ system- Circulatory- artificial blood, artificial heart, pacemaker. Respiratory- artificial lungs. Excretory- Artificial kidney and skin. Artificial Support and replacement of human organs: artificial liver and pancreas. Total joint replacements- artificial limbs. Visual prosthesis -artificial eye/ bionic eye.	
UNIT - V	**8 Hrs**
Biomimetics: Inventions in nature for Human Innovation: Photosynthesis and Photovoltaic cells, Bionic/Artificial leaf. Bio-ink and 3D-Bioprinting. Cellular automata. Biosensors: Artificial tongue and nose. Biomimetic echolation. Insect foot adaptations for adhesion. Thermal insulation and storage materials. Bees and Honeycomb Structure. Artificial Intelligence, Neural Networking and bio-robotics.	

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

CO1	:	Elucidate the concepts and phenomenon of natural processes
CO2	:	Apply the basic principles for design and development of bioinspired structures
CO3	:	Analyse and append the concept of bio-mimetics for diverse applications
CO4	:	Designing technical solutions by utilization of bio-inspiration modules.

Reference Books:

1. D. Floreano and C. Mattiussi, Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, 1st edition, MIT
Press, 2008, ISBN: 9780262062718

2. Guang Yang, Lin Xiao, and Lallepak Lamboni. Bioinspired Materials Science and Engineering. 1st edition, John Wiley,
2018, ISBN: 978-1-119-3903362

3. M.A. Meyers and P.Y. Chen. Biological Materials, Bioinspired Materials, and Biomaterials, 1st edition, Cambridge
University Press, 2014, ISBN 978-1-107-01045.

4. Tao Deng. Bioinspired Engineering of Thermal Materials, 1st edtion, Wiley-VCH Press, 2018. ISBN: 978-3-527-33834-4.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MBT332G	**HEALTH INFORMATICS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr A H Manjunatha Reddy			

UNIT - I	**8 Hrs**
Introduction, Healthcare data, information and knowledge: Data types, data conversion, clinical data warehouse, data analytics, challenges, role of informatics in analytics, future trends	
UNIT - II	**8 Hrs**
Electronic health records: Introduction, scope for the e health records, challenges, examples, logical steps to selecting and implementing EHR	
UNIT - III	**8 Hrs**
Data standards and medical coding: Introduction, medical content standards, termonology standards, transport standards, medical coding and reimbursement, future trends,	
UNIT - IV	**9 Hrs**
Healthcare Enterprise: Overview of Health Informatics: Introduction, Key players in HI, organizations involved, barriers, programs, organizations and career, HI Resoruces	
UNIT - V	**9 Hrs**
Health Information privacy and security: Introduction, basic security principles, authentication and identity management, data security in the cloud and client/server management	

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

CO1	:	Understand the basic principles of Health informatics
CO2	:	Data capture to data transformation and to analysis
CO3	:	Creation of E health records, identify the challenges
CO4	:	Improvise the significant factors as per the spatio-temporal requirements

Reference Books:

1. Robert E. Hoyt Ann K. Yoshihashi, Health Informatics, Practical guide for Healthcare and Information Technology
Professionals, 6th edition, Informatics Education, 2014, ISBN: 978-0-9887529-2-4
2. Kathryn J. Hannah Marion J. Ball, Health Informatics, Springer Series edition, Springer, 2005, ISBN: 1-85233-826-1
3. William R Hersh, Health Informatics, a Practical guide, 8th edition. 2022, ISBN 978-1-387-85475-2
4. Pentti Nieminen. Medical informatics and data analysis 1st edition, MDPI AG, 2021, ISBN-13 : 978-3036500980

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

	RUBRIC for CIE			***RUBRIC for SEE***		
	Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
	1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
	2	Tests - T1 & T2	40			
	3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
		Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
				5 & 6	Unit-3: Question 5 or 6	20
				7 & 8	Unit-4: Question 7 or 8	20
				9 & 10	Unit-5: Question 9 or 10	20
					Total Marks	100

SEMESTER: II						
Course Code	:	MCS331G	**BUSINESS ANALYTICS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Azra Nasreen and Dr. Badarinath K			

UNIT - I	**9 Hrs**
Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling.	
UNIT - II	**9 Hrs**
Trendiness and Regression Analysis Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	
UNIT - III	**8 Hrs**
Organization Structures of Business analytics Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, Predictive Analytics, Predicative Modelling, Predictive analytics analysis.	
UNIT - IV	**8 Hrs**
Forecasting Techniques Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.	
UNIT - V	**8 Hrs**
Decision Analysis Formulating Decision Problems, Decision Strategies with and without Outcome, Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	

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

CO1	:	Apply the concepts and methods of business analytics to solve business problems
CO2	:	Analyse, model and solve decision problems in different settings
CO3	:	Interpret results/solutions and identify appropriate courses of action for a given business scenario
CO4	:	Demonstrate skills like investigation, effective communication, working in team/Individual and following ethical practices by implementing solutions to decision making problems

Reference Books:

1. Business analytics Principles, Concepts, and Applications FT Press Analytics, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, 1st Edition, 2014, ISBN-13: 978-0133989403, ISBN-10: 0133989402

2. The Value of Business Analytics: Identifying the Path to Profitability, Evan Stubs , John Wiley & Sons, |DOI:10.1002/9781118983881,1st Edition 2014, ISBN:978111898388

3. Business Analytics, James Evans, Pearsons Education 2nd Edition, ISBN-13: 978-0321997821 ISBN-10: 0321997824

4. Predictive Business Analytics Forward Looking Capabilities to Improve Business, Gary Cokins and Lawrence Maisel, Wiley; 1st Edition, 2013, ISBN: 978-1-118-17556-9 .

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MCV331G	**INDUSTRIAL AND OCCUPATIONAL HEALTH AND SAFETY**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.V.AnanthaRam			

UNIT - I **08Hrs**

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

UNIT - II **09Hrs**

Occupational health and safety: Introduction, Health, Occupational health: definition, Interaction between work and health, Health hazards, workplace, economy and sustainable development, Work as a factor in health promotion. Health protection and promotion Activities in the workplace: National governments, Management, Workers, Workers' representatives and unions, Communities, Occupational health professionals. Potential health hazards: Air contaminants, Chemical hazards, Biological hazards, Physical hazards, Ergonomic hazards, Psychosocial factors, Evaluation of health hazards: Exposure measurement techniques, Interpretation of findings recommended exposure limits. Controlling hazards: Engineering controls, Work practice controls, Administrative controls. Occupational diseases: Definition, Characteristics of occupational diseases, Prevention of occupational diseases.

UNIT - III **09Hrs**

Hazardous Materials characteristics and effects on health: Introduction, Chemical Agents, Organic Liquids, Gases, Metals and Metallic Compounds, Particulates and Fibers, Alkalies and Oxidizers, General Manufacturing Materials, Chemical Substitutes, Allergens, Carcinogens, Mutagens, Reproductive Hazards, Sensitizers and Teratogens, Recommended Chemical Exposure Limits. Physical Agents, Noise and Vibration, Temperature and Pressure, Carcinogenicity, Mutagenicity and Teratogenicity. Ergonomic Stresses: Stress-Related Health Incidents, Eyestrain, Repetitive Motion, Lower Back Pain, Video
Display Terminals.

UNIT - IV **08 Hrs**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT - V **08 Hrs**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, over hauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

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

CO1	:	Explain the Industrial and Occupational health and safety and its importance.
CO2	:	Demonstrate the exposure of different materials, occupational environment to which the employee can expose in the industries.
CO3	:	Characterize the different type materials, with respect to safety and health hazards of it.
CO4	:	Analyze the different processes with regards to safety and health and the maintenance required in the industries to avoid accidents.

Reference Books:

1.Maintenance Engineering Handbook, Higgins & Morrow, SBN 10: 0070432015 / ISBN 13: 9780070432017, Published by McGraw-Hill Education. Da Information Services.

2. H. P. Garg, Maintenance Engineering Principles, Practices & Management, 2009,S. Chand and Company, New Delhi, ISBN:9788121926447

3.Fundamental Principles of Occupational Health and Safety, Benjamin O. ALLI, Second edition,2008 International Labour Office – Geneva: ILO, ISBN 978-92-2-120454-1

4.Foundation Engineering Handbook, 2008, Winterkorn, Hans, Chapman & Hall London. ISBN:8788111925428.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MCV332G	**INTELLIGENT TRANSPORTATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.Sunil S			

UNIT - I	**8 Hrs**
Introduction: –Historical Background, Definition, Future prospectus, ITS training and educational needs. Fundamentals of Traffic Flow and Control- Traffic flow elements, Traffic flow models, Shock waves in Traffic streams, Traffic signalization and control principles, Ramp metering, Traffic simulation	
UNIT - II	**9 Hrs**
ITS User services-User services bundles, Travel and Traffic management, Public Transportation Operations, Electronic Payment, Commercial Vehicles Operations, Emergency Management, Advanced Vehicle Control and safety systems, Information Management, Maintenance and construction Management. ITS Architecture-Regional and Project ITS Architecture, Need of ITS architecture, concept of Operations, National ITS Architecture, Architecture development tool	
UNIT - III	**9 Hrs**
Technology Building Blocks for ITS-Introduction, Data acquisition, Communication Tools, Data Analysis, and Traveller Information. Various detection, identification and collection methods for ITS. ITS Applications and their benefits-Freeway and incident management systems, Advanced arterial traffic control systems, Advanced Public Transportation Systems, Multimodal Traveller Information systems	
UNIT - IV	**8 Hrs**
ITS Planning-Transportation planning and ITS, Planning and the National ITS Architecture, Planning for ITS, Integrating ITS into Transportation Planning, relevant case studies. ITS Standards-Standard development process, National ITS architecture and standards, ITS standards application areas, National Transportation Communications for ITS Protocol, Standards testing	
UNIT - V	**8 Hrs**
ITS Evaluation – Project selection at the planning level, Deployment Tracking, Impact Assessment, Benefits by ITS components, Evaluation Guidelines, Challenges and Opportunities. ITS for Law Enforcement: Introduction, Enhance and support the enforcement traffic rules and regulations, ITS Funding options and ITS case studies	

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

CO1	:	Identify and apply ITS applications at different levels
CO2	:	Illustrate ITS architecture for planning process
CO3	:	Examine the significance of ITS for various levels
CO4	:	Compose the importance of ITS in implimentions

Reference Books:

1. Pradip Kumar Sarkar and Amit Kumar Jain, “Intelligent Transport Systems”, PHI Learning Private Limited, Delhi,2018, ISBN-9789387472068

2. Choudury M A and Sadek A, “Fundamentals of Intelligent Transportation Systems Planning” Artech House publishers (31 March 2003); ISBN-10: 1580531601

3. Bob Williams, “Intelligent transportation systems standards”, Artech House, London, 2008. ISBN-13: 978-1-59693-291-3

4. Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio García Zuazola “Intelligent Transport Systems: Technologies and Applications” Wiley Publishing ©2015, ISBN:1118894782 9781118894781

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem.

Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

	RUBRIC for CIE			***RUBRIC for SEE***		
	Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
	1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
	2	Tests - T1 & T2	40			
	3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
		Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
				5 & 6	Unit-3: Question 5 or 6	20
				7 & 8	Unit-4: Question 7 or 8	20
				9 & 10	Unit-5: Question 9 or 10	20
					Total Marks	100

SEMESTER: II						
Course Code	:	MEC331G	**ELECTRONIC SYSTEM DESIGN**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Ravishankar Holla			

UNIT - I	**9 Hrs**
Design Process & its Fundamentals: Life Cycle of Electronic Products, Design and Development Process, Guidance for Product Planning, Design and Development, Technical Drawings, Circuit Diagrams, Computer-Aided Design (CAD)	
UNIT - II	**9 Hrs**
System Architecture and Protection Requirements: Introduction - Terminology, Functions and Structures, Systems Design Architecture, Electronic System Levels, System Protection Experiential Learning: (4 quizzes on the below mentioned topics other than CIE) Reliability Analysis: Introduction, Calculation Principles, Exponential Distribution, Failure of Electronic, Components, Failure of Electronic Systems, Reliability Analysis of Electronic Systems, Recommendations for Improving Reliability of Electronic Systems	
UNIT - III	**8 Hrs**
Thermal Management and Cooling: Introduction - Terminology, Temperatures and Power Dissipation, Calculation Principles, Heat Transfer, Methods to Increase Heat Transfer, Application Examples in Electronic Systems, Recommendations for Thermal Management of Electronic Systems, Cooling systems, liquid, air and non cooling systems.	
UNIT - IV	**8 Hrs**
Electromagnetic Compatibility (EMC): Introduction, Coupling Between System Components, Grounding Electronic Systems, Shielding from Fields, Electrostatic Discharge (ESD), Recommendations for EMC-compliant Systems Design	
UNIT - V	**8 Hrs**
Recycling Requirements and Design for Environmental Compliance: Introduction - Motivation and the Circular Economy, Manufacture, Use, and Disposal of Electronic Systems in the Circular Economy, Product Recycling in the Disposal Process, Material Recycling in the Disposal Process, Design and Development for Disassembly, Material Suitability in Design and Development, Recommendations for Environmentally Compliant Systems	

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

CO1	:	Realize the fundamentals of Design, Architecture, thermal management, EMC and Recycling requirements of Electronic System Design
CO2	:	Analyze the various application wise design requirements in Electronic systems along with the related concepts of implementations, standards and Compliances.
CO3	:	Use modern open source tools to realize the various concepts of Electronic system design
CO4	:	Engage in self-study through assignments, simulations, case studies and projects

Reference Books:

1. Fundamentals of Electronic Systems Design, Jens Lienig, Hans Brümmer 2017, Springer International Publishing, ISBN
978-3-319-55839-4, DOI:10.1007/978-3-319-55840-0
2. “Embedded System Design”, Marwedel, Peter, Springer Nature, 10.1007/978-3-030-60910-8
3. “Electromagnetic Compatibility Engineering”, Henry W. Ott, WILEY Publication, ISBN: 978-0-470-18930-6
4. "Handbook of Electronic Systems Design" by Charles A. Harper, McGraw-Hill Inc.,US , 0070266832, 978-0070266834

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom’s Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based

seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MEC332G	**EVOLUTION OF WIRELESS TECHNOLOGIES**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Mahesh A			

UNIT - I	**9 Hrs**
Introduction to cellular systems: Overview of Cellular Systems and evolution 2G/3G/4G/5G, Cellular Concepts – Frequency reuse, Co channel and Adjacent channel Interference, C/I, Handoff, Blocking, Erlang Capacity, Bluetooth, WiFi, WWAN and PAN.	
UNIT - II	**9 Hrs**
Fundamentals of wireless communication: Wireless Channel, Wireless propagation, Link budget, Free-space path loss, Noise figure of receiver, Multipath fading, Shadowing, Fading margin, Shadowing margin, Wireless Channel Capacity, OFDM and LTE, Large Scale Propagation effects and Channel Models	
UNIT - III	**8 Hrs**
Fundamentals of 5G architecture: Difference between 4G and 5G, 5G Architecture, Planning of 5G Network, Quality of Service, Radio Network, Requirements, Security, SIM in 5G Era, Specifications, Standardization, Terminal States	
UNIT - IV	**8 Hrs**
mmWave and Visible Light Communications: Back ground and concept of mmWave Communications, Frequency bands, propagation characteristics, channel models, applications and challenges in 5G	
UNIT - V	**8 Hrs**
Future Generations: Future Generations(where is the 6G?), Health Considerations, Identifiers, Interfaces, ,Key Derivation, Location Based Services, Massive Internet of Things, Measurements, Network Functions Virtualization, Network Slicing, Open Source, , User Equipment, Vehicle-to-Vehicle communications (V2V),Virtual Reality (VR/AR/XR). Case study- Bharath Stack	

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

CO1	:	Demonstrate their understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards
CO2	:	Compare different technologies used for wireless communication systems.
CO3	:	Demonstrate an ability explain recent techniques for Wireless Communication systems
CO4	:	Update the latest trends in wireless communications

Reference Books:

1. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", Pearson, 2nd Edition.
2. Aditya K Jagannatham, "Principles of Modern Wireless Communications", McGraw Hill, 2017
3. Robin Chataut, Robert Akl, "Massive MIMO Systems for 5G and beyond Networks—Overview, Recent Trends, Challenges, and Future Research Direction" Sensors, May 2020
4. A. N. Uwaechia and N. M. Mahyuddin, A Comprehensive Survey on Millimeter Wave, Communications for Fifth-Generation Wireless Networks: Feasibility and Challenges, in IEEE, Access, vol. 8, pp. 62367-62414, 2020

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100
QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.
TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.
EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			*RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MET331G	**TRACKING AND NAVIGATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Shambulinga .M, Dr. B. Roja Reddy			

UNIT - I	**9 Hrs**
An Introduction to Radar: Basic Radar, The simple form of the Radar Equation, Radar Block Diagram, Radar Frequencies, Application of radar, Types of Radars. Detection of signals in Noise, Receiver Noise and the Signal-to Noise Ratio, Probability of Detection and False alarm, Introduction to Doppler, MTI, UWB Radars	
UNIT - II	**8 Hrs**
Terrestrial Network based positioning and navigation: General Issues of wireless positions location, Fundamentals, positioning in cellular networks, positioning in WLANs, Positioning in Wireless sensor networks.	
UNIT - III	**8 Hrs**
Satellite-based navigation systems: Global Navigation satellite systems (GNSS), GNSS receivers.	
UNIT - IV	**9 Hrs**
LiDAR: Introduction to LiDAR, context and conceptual discussion of LiDAR, Types of LiDARS, LiDARS Detection modes, Flash LiDAR versus Scanning LiDAR, Monostatic versus Bistatic LiDAR, Major Devices in a LiDAR, LiDAR remote sensing, Basic components and physical principles of LiDAR, LiDAR accuracy and data formats.	
UNIT - V	**8 Hrs**
SONAR: Underwater acoustics, applications, comparison with radar, submarine detection and warfare, overcoming the effects of the ocean, sonar and information processing.Transmission of the acoustic signal: Introduction, detection contrast and detection index, transmission equation, equation of passive and active sonar.	

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

CO1	:	Understand the concepts of Radar, LiDAR, Sonar, terrestrial and satellite based navigation system
CO2	:	Apply the concepts of radars, LiDAR, Sonar, cellular networks, WLAN, sensor networks and satellites in determining the user position and navigation.
CO3	:	Analyze the different parameters of satellite and terrestrial networks for navigation systems.
CO4	:	Evaluate the Radar, LiDAR, Sonar systems and satellite and terrestrial network based navigation and tracking systems

Reference Books:

1. M. L Skolnik,Introduction to RADAR Systems,3rd edition, 2017,TATA Mcgraw-Hill, ISBN: 978-0070445338

2. Mark A Richards, James A Scheer, William A Holam,Principles of Modern Radar Basic Principles, 2010, 1st edition,SciTech Publishing Inc, ISBN:978-1891121524 .

3. Davide dardari, Emanuela Falletti, Marco Luise, Satellite and Terrestrial Radio Positioning techniques- A signal processing perspective, 1st Edition, 2012, Elsevier Academic Press, ISBN: 978-0-12-382084-6.

4. Paul McManamon,LiDAR Technologies and Systems, SPIE press, 2019.

5. Pinliang Dong and Qi Chen,LiDAR Remote Sensing and Applications, CRC Press, 2018, ISBN: 978-1-4822-4301-7

6. Jean-Paul Marage, Yvon Mori, Sonar and Underwater Acoustics, Wiley, 2013, ISBN: 9781118600658

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

	RUBRIC for CIE			***RUBRIC for SEE***		
	Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
	1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
	2	Tests - T1 & T2	40			
	3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
		Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
				5 & 6	Unit-3: Question 5 or 6	20
				7 & 8	Unit-4: Question 7 or 8	20
				9 & 10	Unit-5: Question 9 or 10	20
					Total Marks	100

SEMESTER: II						
Course Code	:	MIM331G	**PROJECT MANAGEMENT**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Vikram N Bahadurdesai			

UNIT - I	**8 Hrs**
Introduction: Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS), Introduction to Agile Methodology.	
UNIT - II	**8 Hrs**
Capital Budgeting: Capital Investments: Importance and Difficulties, phases of capital budgeting, levels of decision making, facets of project analysis, feasibility study – a schematic diagram, objectives of capital budgeting	
UNIT - III	**9 Hrs**
Project Costing: Cost of Project, Means of Finance, Cost of Production, Working Capital Requirement and its Financing, Profitability Projections, Projected Cash Flow Statement, Projected Balance Sheet, Multi-year Projections, Financial Modeling, Social Cost Benefit Analysis	
UNIT - IV	**8 Hrs**
Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Critical Path Method (CPM), Computerized project management	
UNIT - V	**9 Hrs**
Project Management and Certification: An introduction to SEI, CMMI and project management institute USA – importance of the same for the industry and practitioners. PMBOK 6 - Introduction to Agile Methodology, hemes / Epics / Stories, Implementing Agile. Domain Specific Case Studies on Project Management: Case studies covering project planning, scheduling, use of tools & techniques, performance measurement.	

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

CO1	:	Explain project planning activities that accurately forecast project costs, timelines, and quality.
CO2	:	Evaluate the budget and cost analysis of project feasibility.
CO3	:	Analyze the concepts, tools and techniques for managing projects.
CO4	:	Illustrate project management practices to meet the needs of Domain specific stakeholders from multiple sectors of the economy (i.e. consulting, government, arts, media, and charity organizations).

Reference Books:

1. Prasanna Chandra, Project Planning Analysis Selection Financing Implementation & Review, Tata McGraw Hill Publication, 8th Edition, 2010, ISBN 0-07-007793-2.

2. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), 5th Edition, 2013, ISBN: 978-1-935589-67-9

3. Harold Kerzner, Project Management A System approach to Planning Scheduling & Controlling, John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.

4. Rory Burke, Project Management – Planning and Controlling Techniques, John Wiley & Sons, 4th Edition, 2004, ISBN: 9812-53-121-1

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MIS331G	**DATABASE AND INFORMATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof.Smitha G R			

UNIT - I	**8 Hrs**
Advanced Database Models, Systems, and Applications : Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia, and Deductive Databases . Distributed Database Concepts : Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control and Recovery in Distributed Databases	
UNIT - II	**8 Hrs**
Introduction to Information Retrieval and Web Search : Information Retrieval (IR) Concepts Retrieval Models, Types of Queries in IR Systems , Text Preprocessing , Inverted Indexing, Evaluation Measures of Search Relevance ,Web Search and Analysis, Trends in Information Retrieval .	
UNIT - III	**8 Hrs**
Information Systems, Organizations and Strategy: Organizations and information systems, How information systems impact organization and business firms, Using information systems to gain competitive advantage, management issues, Ethical and Social issues in Information Systems: Understanding ethical and Social issues related to Information Systems, Ethics in an information society, The moral dimensions of information society. A Case study on business planning.	
UNIT - IV	**9 Hrs**
Achieving Operational Excellence and Customer Intimacy: Enterprise systems, Supply chain management(SCM) systems, Customer relationship management(CRM) systems, Enterprise application. E-commerce: Digital Markets Digital Goods: E-commerce and the internet, E-commerce-business and technology, The mobile digital platform and mobile E-commerce, Building and E-commerce web site. A Case study on ERP.	
UNIT - V	**9 Hrs**
Managing Knowledge: The knowledge management landscape, Enterprise-wide knowledge management system, Knowledge work systems, Intelligent techniques. Enhancing Decision Making: Decision making and information systems, Business intelligence in the enterprise. Business intelligence constituencies. Building Information Systems: Systems as planned organizational change, Overview of systems development.	

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

CO1	:	Understand the different models for Infromation Retrieval.
CO2	:	Appricieate the technology of Information Retrieval and Web Search
CO3	:	To understand the basic principles and working of information technology.
CO4	:	Describe the role of information technology and information systems in business.

Reference Books:

1. Kenneth C. Laudon and Jane P. Laudon: Management Information System, Managing the Digital Firm, Pearson Education, 14th Global edition, 2016, ISBN:9781292094007.

2. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, 7th Edition, 2016, Published by Pearson,
Copyright © , ISBN-10: 0133970779

3. James A. O' Brien, George M. Marakas: Management Information Systems, Global McGraw Hill, 10th Edition, 2011, ISBN:
978-0072823110.

4. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, 2003, McGraw-Hill, ISBN:
9780071231510

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MIS332G	**MANAGEMENT INFORMATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Vanishree K			

UNIT - I **8 Hrs**

Overview: Introduction:
Professional Software Development, Software Engineering Ethics, Case studies. Software Processes: Models, Process activities, Coping with Change, Process improvement. The Rational Unified Process. Computer Aided Software Engineering. Agile Software Development: Introduction to agile methods, Agile development techniques, Agile project management and scaling agile methods. Information Systems in Global Business Today: The role of information systems in business today, Perspectives on information systems, Contemporary approaches to information systems

UNIT - II **9 Hrs**

Requirements Engineering and System Modeling:
Software Requirements: Functional and Non-functional requirements. Requirements Elicitation, Specification, Validation and Change. System Modeling: Context models, Interaction models, Structural models, Behavioural models, Model driven architecture. Information Systems, Organizations and Strategy: Organizations and information systems, How information systems impact organization and business firms, Using information systems to gain competitive advantage, management issues

UNIT - III **9 Hrs**

Development and Testing:
Design and implementation: Object oriented design using UML, Design patterns, Implementation issues, Open-source development. Software Testing: Development testing, Test-driven development, Release testing, User testing.
Securing Information Systems: System vulnerability and abuse, Business value of security and control, Establishing
framework for security and control, Technology and tools for protecting information resources. A case study on cybercrime.

UNIT - IV **8 Hrs**

Advanced Software Engineering:
Dependable systems: Dependability properties, Sociotechnical systems, dependable processes, formal methods and dependability, A15 Availability and reliability, reliability requirements, Reliability measurements E-commerce: Digital Markets Digital Goods: E-commerce and the internet, E-commerce-business and technology, A Case study on ERP.

UNIT - V **8 Hrs**

Software Management:
Project Management: Risk Management, Managing People, Teamwork, Project Planning: Software Pricing, Plan driven development, Project Scheduling, Agile planning, Estimation Techniques, COCOMO cost modeling. Building Information Systems: Systems as planned organizational change, Overview of systems development.

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

CO1	:	Understand and apply the fundamental concepts of software engineering for information systems.
CO2	:	Develop the knowledge about software engineering for management of information systems.
CO3	:	Interpret and recommend the use information technology to solve business problems.
CO4	:	Apply a framework and process for aligning organization's IT objectives with business strategy.

Reference Books:

1. Kenneth C. Laudon and Jane P. Laudon: Management Information System, Managing the Digital Firm, Pearson Education, 14th Global edition, 2016, ISBN:9781292094007.

2. Ian Sommerville,— Software Engineering, 9th Edition, Pearson Education, 2013, ISBN: 9788131762165

3. W.S. Jawadekar: Management Information Systems, Tata McGraw Hill, 2006, ISBN: 9780070616349.

4. James A. O' Brien, George M. Marakas: Management Information Systems, Global McGraw Hill, 10th Edition, 2011, ISBN: 978-0072823110

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

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EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem.

Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MMA331G	**STATISTICAL AND OPTIMIZATION METHODS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. PRAKASH R			

UNIT - I **9 Hrs**

Random Vectors:
Probability models of N random variables, Vector notation, Marginal probability functions, Independence of random variables and random vectors, Functions of random vectors, Expected value vector and Correlation matrix, Gaussian random vectors, Expected values of sums, Probability density function of the sum of two random variables, Moment Generating Functions (MGF), MGF of the sum of independent random variables, Characteristic function and Probability generating function.

UNIT - II **8 Hrs**

Estimation: Point estimation, Estimator and estimate, Criteria for good estimates - unbiasedness, consistency, efficiency and sufficiency, Variance of a point estimator, Methods of point estimation - Method of moments and Method of maximum
likelihood, Bayesian estimation of parameters.

UNIT - III **9 Hrs**

Inferential Statistics: Principles of Statistical Inference, Formulation of the problems with examples. Test of hypothesis - Null and alternative hypothesis, Procedure for statistical testing, Type I and Type II errors: level of significance, Rejection regions and power, Standard Normal null distribution (Z-test), Z-tests for means and proportions, Duality: two-sided tests and two-sided confidence intervals, P-value, Inference about variances, Special tests of significance for large and small
samples (F, Chi – square, Z, t – test).

UNIT - IV **8 Hrs**

Fuzzy Optimization:
Basic concepts of fuzzy sets - Operations on fuzzy sets, Fuzzy relation equations, Fuzzy logic control, Fuzzification, Defuzzificatiuon, Knowledge base, Decision making logic, Membership functions, Rule base.
Artificial Neural Networks: Introduction - Neuron model, Multilayer perceptions - Back propagation algorithm and its
variants, Loss functions in artificial neural networks, Stochastic gradient descent method.

UNIT - V **8 Hrs**

Machine Learning Algorithms:
Data mining, Hierarchy Clustering, k-Means Clustering, Distance Metric, Data mining for Big data, Characteristics of Big data, Statistical nature of Big data, Support Vector Machines, Statistical Learning Theory, Linear Support Vector Machine, Kernel functions and Nonlinear Support Vector Machines.

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

CO1	:	Illustrate the fundamental concepts of statistics, random variables, estimation, inferential statistics, fuzzy optimization and machine learning algorithms.
CO2	:	Derive the solution by applying the acquired knowledge of random variables, estimation, inferential statistics, fuzzy optimization and machine learning algorithms to the problems of engineering applications.
CO3	:	Evaluate the solution of the problems using appropriate statistical and probability techniques to the real world problems arising in many practical situations.
CO4	:	Compile the overall knowledge of statistics, probability distributions and estimation, tests of hypothesis and optimization gained to engage in life – long learning.

Reference Books:

1. Roy D. Yates, David J. Goodman, “Probability and Stochastic Processes”, 3rd Edition, An Indian Adaptation, Wiley, 2021,
ISBN: 9789354243455.

2. Douglas C. Montgomery and George C. Runger, “Applied Statistics and Probability for Engineers”, 7th Edition, John Wiley
& Sons, 2019, ISBN: 9781119570615.

3. Trevor Hastie Robert Tibshirani Jerome Friedman, "The Elements of Statistical Learning - Data Mining, Inference, and
Prediction", 2nd Edition, Springer, 2009 (Reprint 2017), ISBN-10: 0387848576, ISBN-13: 9780387848570.

4. Michael Baron, "Probability and Statistics for Computer Scientists", 2nd Edition, CRC Press, 2014, ISBN- 13: 978-1-4822-1410-9.

5. Shai Shalev-Shwartz and Shai Ben-David "Understanding Machine Learning: From Theory to Algorithms", 1st Edition,
Cambridge University Press, 2014, ISBN: 978-1-107-05713-5.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MME331G	**INDUSTRY 4.0**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Gopalakrishna H D			

UNIT - I	8 Hrs
Fundamentals of Industry 4.0 Introduction, Industry 4.0, RAMI 4.0 (Reference Architecture Model Industry 4.0), Servitization, Product Service-System (PSS) Industry 4.0 across the Sectors Introduction, Transportation 4.0: Multimodal Transportation Systems, Rail 4.0, Digital Transformation of Railways, Logistics 4.0 (Implications), Fundamentals of Industry 4.0, Introduction, Industry 4.0, RAMI 4.0 (Reference Architecture Model Industry 4.0), Servitization, Product Service-System (PSS) Industry 4.0 across the Sectors Introduction, Transportation 4.0: Multimodal Transportation Systems, Rail 4.0, Digital Transformation of Railways, Logistics 4.0 (Implications)	

UNIT – II	8 Hrs
The Concept of the IIoT: Modern Communication Protocols, Wireless Communication Technologies, Proximity Network Communication Protocols, TCP/IP, API: A Technical Perspective, Middleware Architecture.	

UNIT - III	8 Hrs
Data Analytics in Manufacturing: Introduction, Power Consumption in manufacturing, Anomaly Detection in Air Conditioning, Smart Remote Machinery Maintenance Systems with Komatsu, Quality Prediction in Steel Manufacturing. Internet of Things and New Value Proposition, Introduction, Internet of Things Examples, IoTs Value Creation Barriers: Standards, Security and Privacy Concerns. Advances in Robotics in the Era of Industry 4.0, Introduction, Recent Technological Components of Robots, Advanced Sensor Technologies, Artificial Intelligence, Internet of Robotic Things, Cloud Robotics.	

UNIT - IV	9 Hrs
Additive Manufacturing Technologies and Applications: Introduction, Additive Manufacturing (AM) Technologies, Stereo lithography, 3DP, Fused Deposition Modeling, Selective Laser Sintering, Laminated Object Manufacturing, Laser Engineered Net Shaping, Advantages of Additive Manufacturing, Disadvantages of Additive Manufacturing. Advances in Virtual Factory Research and Applications, The State of Art, The Virtual Factory Software , Limitations of the Commercial Software.	

UNIT - V	9 Hrs
Augmented Reality: Definitions and application of AR, VR, MR, Limitations of AR, VR, Hardware devices and Software systems, Technical issues and challenges in AR, Industrial applications, IoT and the Need for Data Rationalization Internet of Things (IoT), Internet of Things Vision, Internet of Things (IoT) Frameworks, Architecture of Internet of Things (IoT), Visualizing the Internet of Things (IoT), Essential Technologies of the Internet of Things (IoT), Key Technologies Involved in Internet of Things, Enablers of IoT, Collaborative Operations , Training. Smart Factories: Introduction, Smart factories in action, Importance, Real world smart factories, The way forward. A Roadmap: Digital Transformation, Transforming Operational Processes, Business Models, Increase Operational Efficiency, Develop New Business Models.	

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

CO1	:	Understand the opportunities, challenges brought about by Industry 4.0 for benefits of organizations and individuals
CO2	:	Analyze the effectiveness of Smart Factories, Smart cities, Smart products and Smart services
CO3	:	Apply the Industrial 4.0 concepts in a manufacturing plant to improve productivity and profits
CO4	:	Evaluate the effectiveness of Cloud Computing in a networked economy

Reference Books:

1. Alasdair Gilchrist, Industry 4.0 The Industrial Internet Of Things, Apress Publisher, ISBN-13 (pbk): 978-1-4842-2046-7

2. Alp Ustundag, Emre Cevikcan, Industry 4.0: Managing The Digital Transformation, Springer, 2018 ISBN 978-3-319-57869-9.

3.Ovidiu Vermesan and Peer Friess, Designing the industry - Internet of things connecting the physical, digital and virtualworlds, Rivers Publishers, 2016 ISBN 978-87-93379-81-7

4.Christoph Jan Bartodziej, The concept Industry 4.0- An Empirical Analysis of Technologies and Applications in Production Logistics, Springer Gabler, 2017 ISBN 978-3-6581-6502-4.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIV full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II						
Course Code	:	MST331L	**ANALYSIS AND DESIGN OF STRUCTURES LAB-2**	CIE Marks	:	50
Credits L-T-P	:	1 - 0 - 1		SEE Marks	:	50
Hours	:	14L + 28P	*(Coding / Skill Laboratory)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof.Ashwin Thammiah/Prof.Shriti Badami			

Content **28 Hrs**

1. Analysis of a Plane and Space Truss 2. Analysis of Continuous Beams 3. Analysis of Plane and Space Frames
4. Analysis of Structures with Flat slab and Waffle Slab. 5. Analysis and Design of Multi-Storey RCC Building.
6. Analysis and Design of Multi-Storey Steel Building. 7. Analysis and Design of Buildings subjected to Earthquake
8. Analysis and Design of Buildings subjected to Earthquake Loads (Response Spectrum)
9. Analysis and Design of Buildings subjected to Pushover loads. 10. Analysis and Design of Buildings subjected t
11. Analysis and Design of Buildings subjected to Wind Loads.
12. Analysis and Design of Shear Walls using Section Designer.

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

CO1	:	Apply knowledge of Structural Analysis and Design to model and analyze structures on ETABS.
CO2	:	Analyze a building component subjected to various loads using ETABS.
CO3	:	Design various building components as per Codal Provisions using ETABS.
CO4	:	Distinguish between the various static and dynamics types of analyses performed on structures using ETABS.

Scheme of Continuous Internal Evaluation (CIE- Laboratory) : Only LAB Course 30 + 10 + 10 = 50. The Laboratory session is held every week as per the timetable and the performance of the student is evaluated in every session. The average of marks over number of experiments conducted over the weeks is considered for 30 Marks i.e (Lab Report, Observation & Analysis). The students are encouraged to implement additional innovative experiments in the lab (10 marks). At the end of the semester a test is conducted for 10 Marks (Lab Test). This adds to 50 Marks.

Scheme of Semester End Examination (SEE- Laboratory) : Only LAB Course 40 + 10 =50. Students will be evaluated for Write-up, Experimental Setup, Experiment Conduction with Results, Analysis & Discussions for 40 Marks and Viva will be conducted for 10 Marks adding to 50 Marks.

Only LAB Courses with 50 Marks

RUBRIC FOR CIE			RUBRIC FOR SEE	
Sl.No	Content	Marks	Content	Marks
1	Write Up, Setup, Conduction Results, Analysis & Discussions	30	1. Write Up, Setup, Conduction 2. Results, Analysis & Discussions	40
2	Innovative Experiment/Concept Design & Implementation	10		
3	Laboratory Internal	10	Viva Voce	10
	Total Marks	50	Total Marks	50

SEMESTER: II						
Course Code	:	**MHS131T**	**PROFESSIONAL SKILL DEVELOPMENT- I**	CIE Marks	:	50
Credits L-T-P	:	2-0-0		SEE Marks	:	50
Hours	:	28L	*Common Course to all M.Tech Programs*	SEE Durations	:	2 Hrs
Faculty Coordinator:			Dr. C.Bindu Ashwini			

UNIT - I	4 Hrs
Communication Skills: Basics of Communication, Personal Skills & Presentation Skills – Introduction, Application, Simulation, Attitudinal Development, Self Confidence, SWOC analysis. Resume Writing: Understanding the basic essentials for a resume, Resume writing tips Guidelines for better presentation of facts. Theory and Applications.	
UNIT - II	8 Hrs
Quantitative Aptitude and Data Analysis: Number Systems, Math Vocabulary, fraction decimals, digit places etc. Simple equations – Linear equations, Elimination Method, Substitution method, Inequalities. Reasoning – a. Verbal - Blood Relation, Sense of Direction, Arithmetic & Alphabet. b. Non- Verbal reasoning - Visual Sequence, Visual analogy and classification. Analytical Reasoning - Single & Multiple comparisons, Linear Sequencing. Logical Aptitude, - Syllogism, Venn-diagram method, Three statement syllogism, Deductive and inductive reasoning. Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions. Verbal Analogies/Aptitude – introduction to different question types – analogies, Grammar review, sentence completions, sentence corrections, antonyms/synonyms, vocabulary building etc. Reading Comprehension, Problem Solving,	
UNIT - III	6 Hrs
Interview Skills: Questions asked & how to handle them, Body language in interview, and Etiquette – Conversational and Professional, Dress code in interview, Professional attire and Grooming, Behavioral and technical interviews, Mock interviews - Mock interviews with different Panels. Practice on Stress Interviews, Technical Interviews, and General HR interviews	
UNIT - IV	5 Hrs
Interpersonal and Managerial Skills: Optimal co-existence, cultural sensitivity, gender sensitivity; capability and maturity model, decision making ability and analysis for brain storming; Group discussion(Assertiveness) and presentation skills;	
UNIT - V	5 Hrs
Motivation: Self-motivation, group motivation, Behavioral Management, Inspirational and motivational speech with conclusion. (Examples to be cited). Leadership Skills: Ethics and Integrity, Goal Setting, leadership ability.	

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

CO1	:	Develop professional skill to suit the industry requirement.
CO2	:	Analyze problems using quantitative and reasoning skills

CO3	:	Develop leadership and inter personal working skills.
CO4	:	Demonstrate verbal communication skills with appropriate body language.

Reference Books:

1. The 7 Habits of Highly Effective People, Stephen R Covey Free Press, 2004 Edition, ISBN: 0743272455

2. How to win friends and influence people, Dale Carnegie General Press, 1st Edition, 2016, ISBN: 9789380914787

3. Crucial Conversation: Tools for Talking When Stakes are High, Kerry Patterson, Joseph Grenny, Ron Mcmillan 2012 Edition, McGraw-Hill Publication ISBN: 9780071772204

4. Ethnus, Aptimithra: Best Aptitude Book ,2014 Edition, Tata McGraw Hill ISBN: 9781259058738

Phase *	Activity
I	Test 1 is conducted after the completion of 9 hours of training programme (3 Classes). Question paper will have two parts. Part A will be Quiz for 10 Marks and Part B for 50 Marks Descriptive answers.
II	Test 2 is conducted after the completion of 18 hours of training programme (6 Classes). Question paper will have two parts. Part A will be Quiz for 10 Marks and Part B for 50 Marks Descriptive answers. Total test marks will be reduced to 30 Marks and Total Quiz marks will be 20 Marks. Final CIE would be 50 Marks
	CIE marks 20 Quiz + 30 Test = 50 Marks
Semester End Examination: SEE is conducted for 50 Marks for a duration of 2 hours.	

SEMESTER: III						
Course Code	:	MST361T	**ADVANCED CONSTRUCTION MATERIALS**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*(Professional Core - 5)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Radhakrishna			

UNIT - I	**9 Hrs**
Review of conventional concrete, various methods of proportioning of concrete, proportioning of a concrete mix by IS and ACI method, mineral, and chemical admixtures, and new cementitious materials used for making building materials.	
UNIT - II	**8 Hrs**
Geopolymers – Paste, mortar, concrete, and masonry units. Concept, advantages, Proportioning, Geopolymer masonry, Application. Fire-resistant concrete. Ready Mixed Concrete, Advantages, Components of RMC Plant.	
UNIT - III	**9 Hrs**
Fibre reinforced concrete, behavior in compression and flexure. Types of fibers, Action of fibers, Failure of fibers, Simple design and applications. Light weight concrete, types, Materials used, Design of lightweight concrete, Properties and Applications.	
UNIT - IV	**8 Hrs**
Ferro cement- Concept, materials, construction methods, behavior in tension, Simple design, Applications. High Density concrete- Necessity, Radiation shielding, materials, methods of placement.	
UNIT - V	**8 Hrs**
Nanotechnology and Concrete – nono-Engineering, manipulation of materials at the nanoscale, hydrate- hybridization, nanomaterials in concrete – nano SiO2, nanoTiO2, Nano Al2O3, nano clay, carbon nanotubes, nanofibers, Ultrahigh Performance Concrete,Properties and applications.	

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 applications.
CO4	:	Design and conceptualize mixes for various situations.

Reference Books

1. Concrete Microstructure, Properties and Materials, P. Kumar Mehta, Paulo J. M. Monteiro McGraw Hill Education India Private Limited, New Delhi, Fourth Edition, 2015. ISBN-13: 978-93-393-0476-1.

2. Concrete Technology, A R Santhakumar, Oxford University Press, 2012, ISBN-13:978-0-19-567153-7.

3. Properties of Concrete, Neville. A.M, 4th Edition, Pearson Education, Inc, and Dorling Kindersley Publishing Inc

Code Books:
i) IS 10262: 2009, Concrete Mix proportioning guidelines, First Revision.2009. ii) ACI Committee 211, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete, ACI 211.1-91, American Concrete Institute, Farmington Hills,

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE
Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III						
Course Code	:	MST361D1	**STRUCTURAL RELIABILITY**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Elective D (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr. Ravindra.R			

UNIT - I	**8 Hrs**
Probability mass function, probability density function, mathematical expectation, Chebyshev's theorem. Probability distributions: discrete distributions- Binomial and Poison distributions, continuous distributions-Normal, Lognormal distributions	
UNIT - II	**9 Hrs**
Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability analysis-first order second moment method (FOSM), Point Estimate method (PEM)	
UNIT - III	**9 Hrs**
Evaluation of reliability by First Order Second Moment method (Hasofer-Lind's method). Simulation Techniques: Monte Carlo simulation- statistical experiments, confidence limits, sample size and accuracy, generation of random numbers- random numbers with standard uniform distribution, continuous random variables, discrete random variables.	
UNIT - IV	**8 Hrs**
System Reliability of series, parallel and combined systems, evaluation of probability of survival for determinate and redundant structural system.	
UNIT - V	**8 Hrs**
Reliability based design- Steel and RCC beams by FOSM and advanced FOSM, evaluation of geometrical dimension for given level of safety index.	

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

CO1	:	Apply the theoretical principles of randomness of variables in structural engineering through density functions and probability distribution.
CO2	:	Analyze components of structure to assess safety using concepts related to structural reliability by various methods.
CO3	:	Evaluate the safety reliability index at system level.
CO4	:	Perform reliability based design for beam element at given level of safety.

Reference Books

1.Structural Reliability Analysis and Design ,Ranganathan, R, 2000, Jaico Publishing House, Mumbai, India.ISBN81-7224-851-2

2.Reliability based Analysis and Design for Civil Engineers, Devaraj.V & Ravindra.R,2017, ,I.K.International Publishing House Pvt.Ltd,India,ISBN 978-93-85909-80-1.

3.Probability Concepts in Engineering Planning and Design, Volume –I & II, Ang, A. H. S., and Tang, W. H., 1984, John Wiley and Sons, Inc, New York.ISBN10-047103200X ,ISBN13- 978-0471032007.

4.Probability, Reliability and Statistical Methods in Engineering Design, Achintya Haldar and Sankaran Mahadevan ,2000, Wiley , ISBN10-8126567783.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III						
Course Code	:	MST361D2	**EARTHQUAKE RESISTANT STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Elective D (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			DR M V Renuka Devi			

UNIT - I	**8 Hrs**
Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake, location of epicenter and problems on the same. Quantification of an earthquake – Magnitude of an earthquake, different types, problems on the same. Intensity of an earthquake. Earthquake Hazards, Risk evaluation and Mitigation.	
UNIT - II	**9 Hrs**
Computation of seismic forces, base shear in multi-storied buildings and other strctures – using Equivalent lateral force method, as per provisions in IS-1893 2016.	
UNIT - III	**8 Hrs**
Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storied buildings – using procedures for dynamic analysis as per IS-1893 2016.	
UNIT - IV	**9 Hrs**
Effect of infill masonry walls on frames, modeling concepts of masonry infills, behavior of masonry buildings during earthquakes. Problems on design of equivalent diagonal strut as per IS-1893 2016. Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Problems on forces induced due to torsion as per design provisions in IS-1893 2016.	
UNIT - V	**8 Hrs**
Ductility and energy absorption in buildings. Confinement of concrete for ductility, detailing of columns and beams for ductility, ductile detailing provisions as per IS- 13920 2016. Structural behavior, ductile detailing of shear walls and beam column junctions. Seismic response control concepts – Seismic demand, seismic capacity, Overview of P-Delta, Pushover and Time-history analysis. Performance Based Seismic Engineering methodology, Seismic evaluation. Retrofitting of structures - Classification and applications.	

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

CO1	:	Apply the concepts of structural dynamics to assess the behaviour of structures.
CO2	:	Analyse the response of structures with various configurations.
CO3	:	Evaluate the loads and forces acting on structures as per codal provisions.
CO4	:	Design and detail various structural elements for earthquake loading, as per codal provisions.

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. 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): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full
question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			*RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III						
Course Code	:	MST361D3	**STABILITY OF STRUCTURES**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Elective D (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Dr.Madhavi.K			

UNIT - I	**9 Hrs**
Buckling of columns: Euler's 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, Approximate calculation of critical loads by energy method. Elastically supported columns, Critical load of portal frames with different boundary conditions.	
UNIT - II	**8 Hrs**
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	**8 Hrs**
Buckling of Eccentrically loaded columns: Large deflection theory. 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	**8 Hrs**
Lateral buckling of beams: Lateral buckling of beams in pure bending, Lateral buckling of cantilever beam and narrow rectangular beams. 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.	
UNIT - V	**9 Hrs**
Buckling of thin Plates: Introduction to plate buckling and small deflection theory, Critical load of plate using equilibrium and energy approach,Simply supported rectangular plate with uniform compression in one direction. Buckling of rectangular plates under the action of shearing stresses.	

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

CO1	:	Explain the principles of strength, stability and phenomenon of buckling
CO2	:	Apply the principles of stability to calculate buckling load.
CO3	:	Evaluate the buckling load on column, beam – column, frames and plates using classical and approximate methods.
CO4	:	Develop analytical skills leading to solution of buckling problems

Reference Books

1.Theory of Elastic Stability, Stephen P.Timoshenko, James M Gere, 2nd Edition, Tata McGraw Hill, New Delhi,2010, ISBN-10 0-07-070241-1

2. Chajes, A. "Principles of Structures Stability Theory", 1st Edition, Prentice Hall, 1974.ISBN: 9780137099641

3.Gambhir, "Stability Analysis and Design of Structures", Springer, New York, 2004.ISBN-: 3540207848

4.Guide to Stability Design Criteria for Metal Structures, T.V.Galambos,5th Edition, John Wiley&Sons,Newyork,1998. ISBN 1-4196-5207-9.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. Final test marks will be reduced to 40 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the
problem. Case study-based teaching learning and Program specific requirements (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: 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 full
question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			*RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes - Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests - T1 & T2	40			
3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER III						
Course Code	:	MST461N	**INTERNSHIP**	CIE Marks	:	50
Credits L-T-P	:	0 - 0 - 6		SEE Marks	:	50
Hours/Week	:	12		SEE Durations	:	3 Hrs

Guidelines:

1. The duration of the internship shall be for a period of 6 weeks on full time basis after II semester final exams and before the commencement 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 of the respective PG programme in which the student has enrolled.
4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. 6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be softbound in Ivory color for PG circuit Programs and Light Blue for Non-Circuit Programs.

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

CO1: Apply Engineering and Management principles to solve the problems CO2: Analyze real-time problems and suggest alternate solutions
CO3: Communicate effectively and work in teams
CO4: Imbibe the practice of professional ethics and lifelong learning

Scheme of Continuous Internal Evaluation (CIE):

The evaluation committee shall consist of Guide, Professor, Associate Professor/Assistant Professor. The committee shall assess the presentation and the progress reports.

The evaluation criteria shall be as per the rubrics given below:

Reviews	Activity	Weightage
I	Application of Engineering knowledge in industries, ability to comprehend the functioning of the Organization/ Departments.	40%
II	Importance of Resource Management, Environment and Sustainability. Demonstration and Presentation of Internship work with Report Submission	60%

Scheme for Semester End Evaluation (SEE):

The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner. Evaluation shall be done in batches, not exceeding 6 students per batch.

SEMESTER III						
Course Code	:	MST461P	**MINOR PROJECT**	CIE Marks	:	50
Credits L-T-P	:	0 - 0 - 6		SEE Marks	:	50
Hours/Week	:	12		SEE Durations	:	3 Hrs

Guidelines:

1. Each project group will consist of maximum of two students.
2. Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The minor project would be performed in-house.
5. The implementation of the project must be preferably carried out using the resources available in the department/college.

Course Outcomes: After completing the 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 resource managements skills for projects.
CO4: Synthesize self-learning, team work and ethics.

Scheme of Continuous Internal Examination

Evaluation shall be carried out in three reviews. The evaluation committee shall consist of Guide, Professor and Associate Professor/Assistant Professor.

Phase *	Activity	Weightage
I	Approval of the selected topic, formulation of Problem Statement and Objectives with Synopsis submission	20 %
II	Mid-term seminar to review the progress of the work with documentation	40 %
III	Oral presentation, demonstration and submission of project report	40 %

* Phase wise rubrics to be prepared by the respective departments

CIE Evaluation shall be done with weightage / distribution as follows:

• Selection of the topic & formulation of Problem Statement and Objectives	10 %
• Design and simulation/ Algorithm development/ Experimental setup	25 %
• Conducting experiments/ Implementation / Testing	25 %
• Demonstration & Presentation	25 %
• Report writing	15 %

Scheme of Semester End Examination (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.

- Brief write up about the project 05%
- Methodology and Experimental Results & Discussion 20%
- Presentation / Demonstration of the Project 25%
- Report 20%
- Viva Voce 30%

SEMESTER IV						
Course Code	:	MST491P	**MAJOR PROJECT**	CIE Marks	:	100
Credits L-T-P	:	0 - 0 - 18		SEE Marks	:	100
Hours/Week	:	36		SEE Durations	:	3 Hrs

Guidelines:

1. Major Project is to be carried out for a duration of 18 weeks
2. Students must adhere to the Project Presentation Schedule, report to their guide on a weekly basis and get their Project diary signed by their guide 4. Students must execute the Major Project individually and not in teams.
5. It is mandatory for the students to present/publish their project work in National/International Conferences or Journals
6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be soft bound and in Ivory color for PG circuit Programs and Light Blue for Non-Circuit Programs

Course Outcomes: After completing the 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 and societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life-long learning

Scheme of Continuous Internal Examination

Evaluation shall be carried out in three reviews. The evaluation committee shall consist of Guide, Professor, Associate Professor/Assistant Professor.

Phase *	Activity	Weightage
I	Selection of Project Title, Formulation of Problem Statement and Objectives	20 %
II	Design, Implementation and Testing	40 %
II	Experimental Result & Analysis, Conclusions and Future Scope of Work, Report Writing and Paper Publication	40 %

* Phase wise rubrics to be prepared by the respective departments

Scheme for Semester End Evaluation (SEE):

Major Project SEE evaluation shall be conducted in two stages. This is initiated after fulfilment of submission of Project Report and CIE marks.

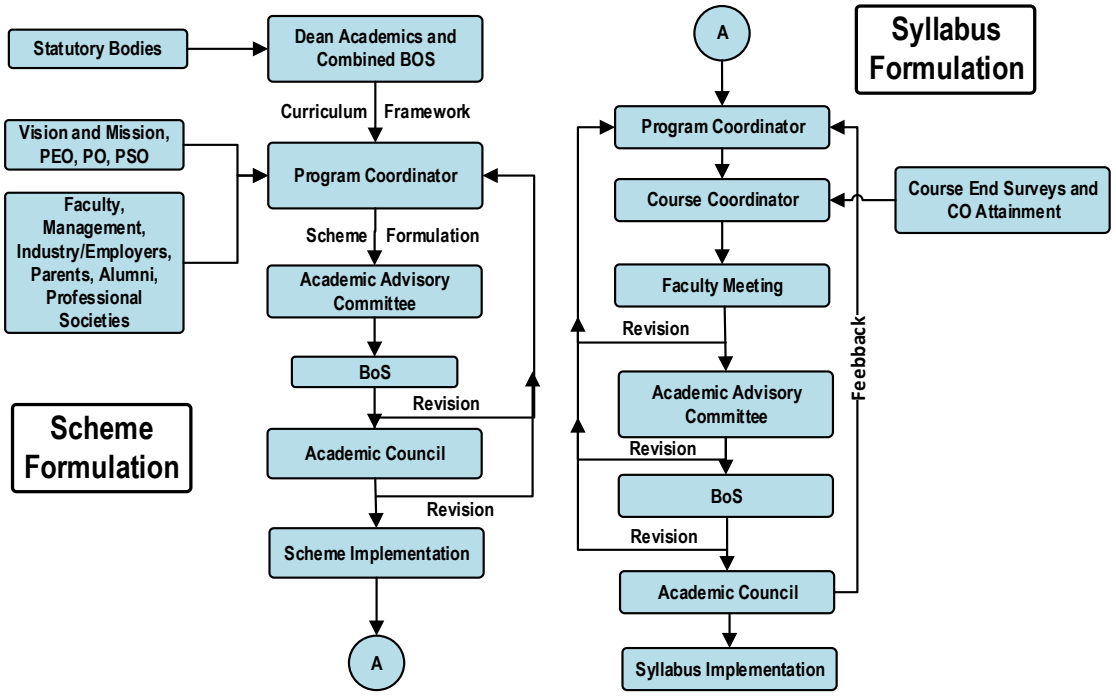
Stage-1 Report Evaluation: Evaluation of Project Report shall be done by the Guide and an External examiner.

Stage-2 Project Viva-voce: Major Project Viva-voce examination is conducted after receipt of evaluation reports from Guide and External examiner.

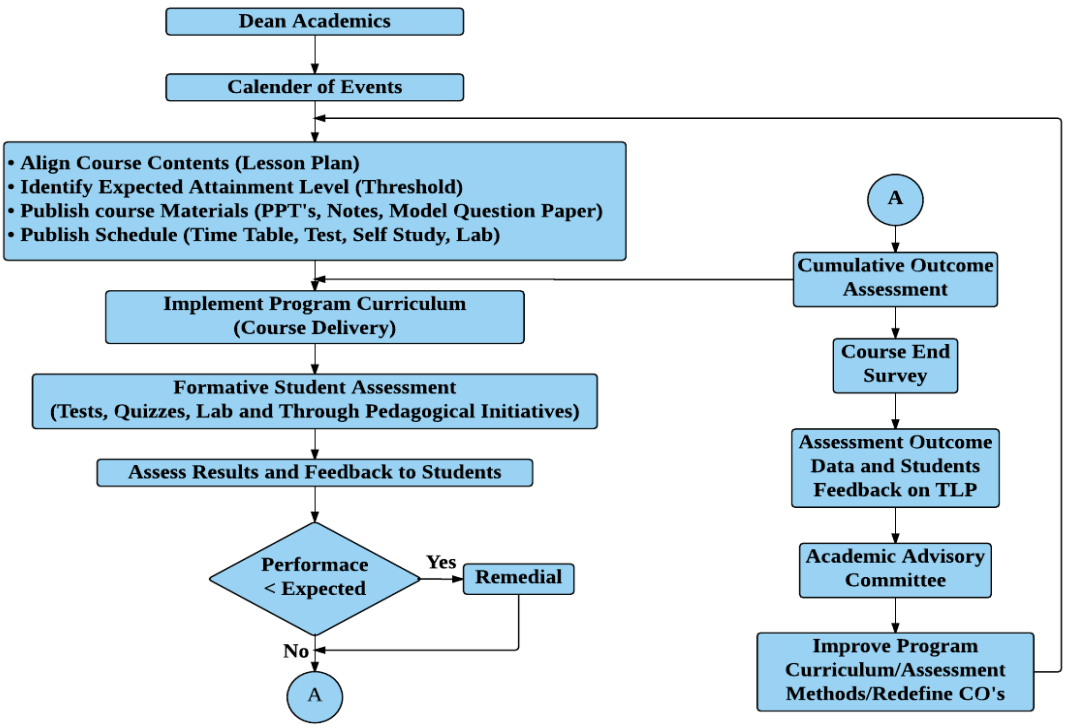
SEE procedure is as follows:

Report Evaluation	Internal Examiner: 100 Marks	**= 200**	
	External Examiner: 100 Marks	200 / 2 = **100**	**A**
Viva-Voce	Jointly evaluated by Internal Guide & External Evaluator	**= 100**	**B**
	Total Marks = (A + B) / 2 =	**100**	

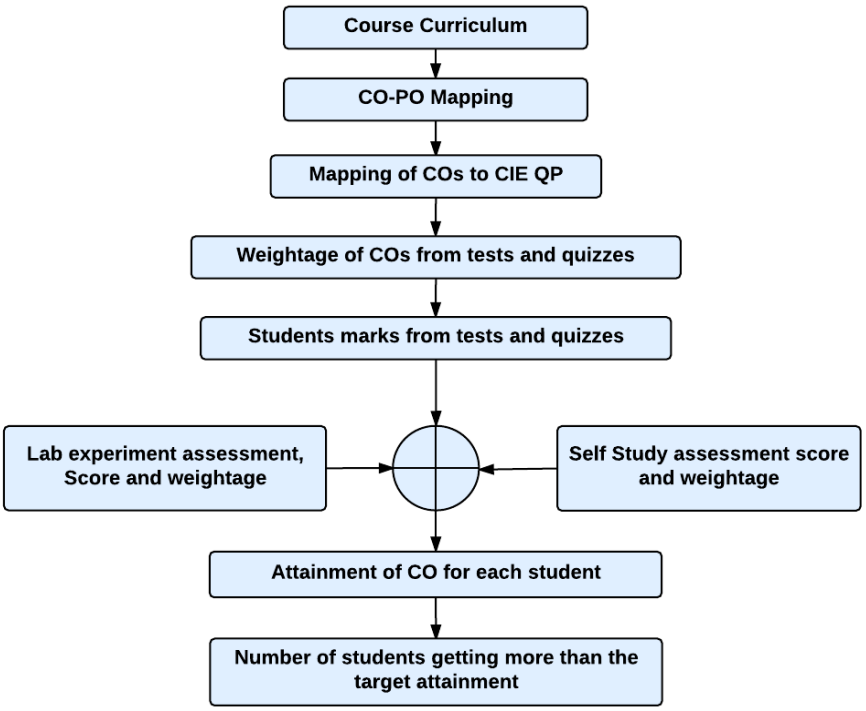
Curriculum Design Process



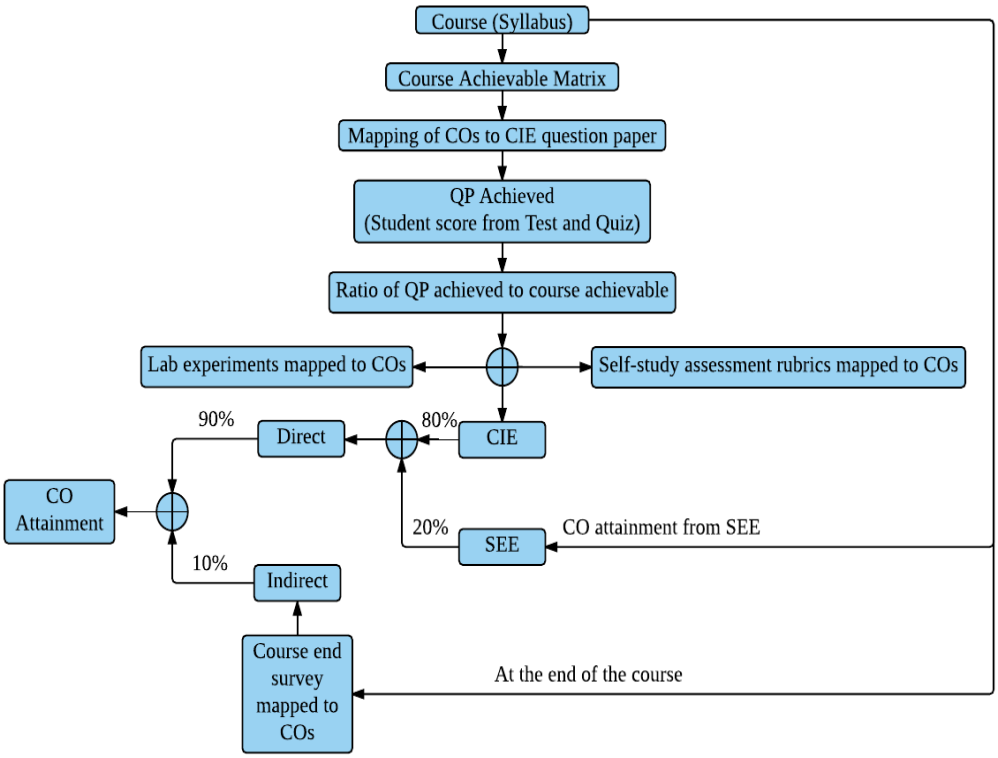
Academic Planning and Implementation



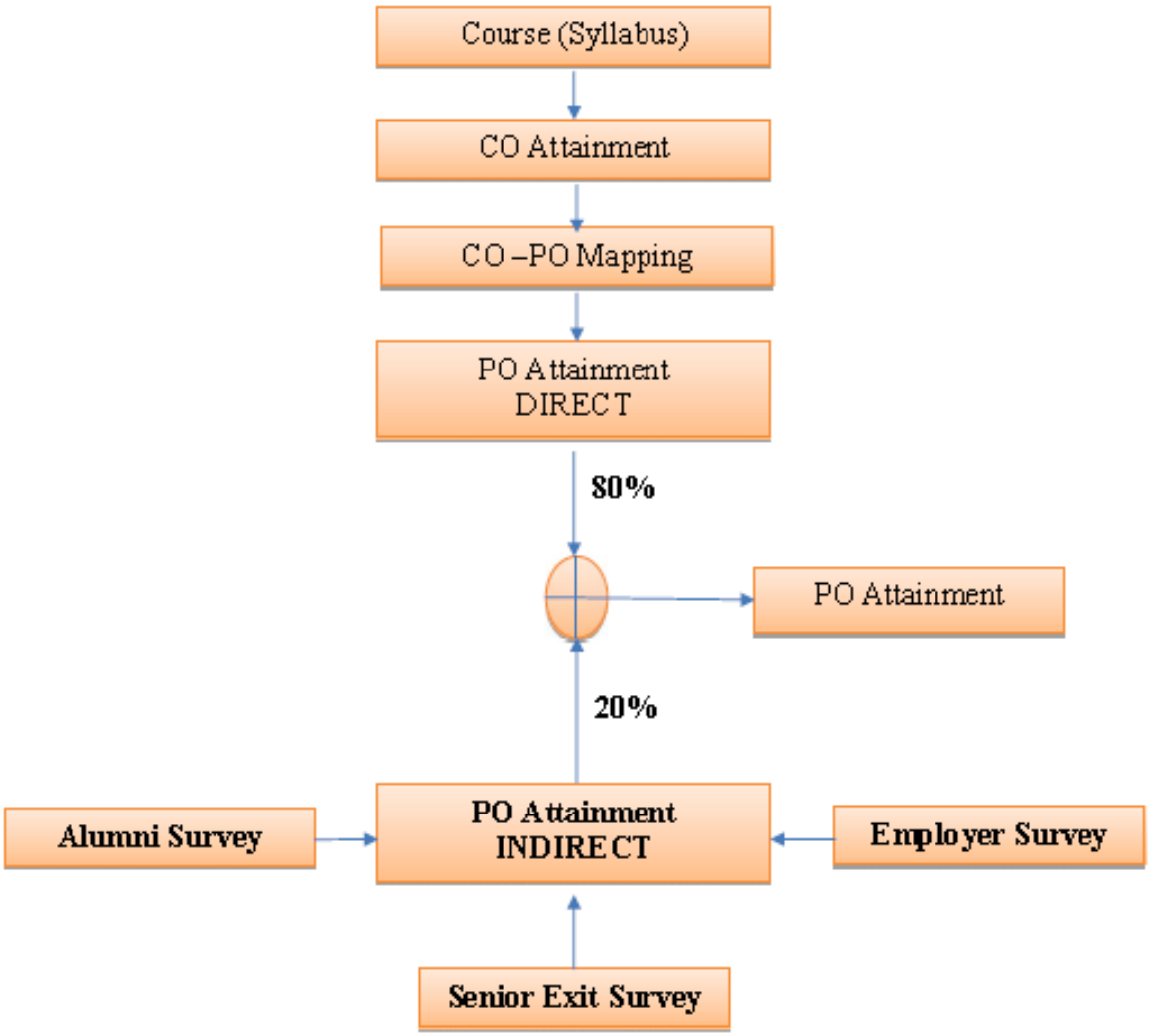
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



INNOVATIVE TEAMS OF RVCE

1. Ashwa Racing : Ashwa Mobility Foundation (AMF) is a student R&D platform that designs and fabricates Formula-themed race cars and future mobility solutions to tackle urban transportation problems.
2. Astra Robotics Team : Involved in the design, fabrication, and building of application-specific robots.
3. Coding Club : To facilitate students in acquiring the skills, confidence, and opportunities to change their world using coding. The club aims to help students become successful in GSoC, ACM-ICPC, and other recognized coding competitions.
4. Entrepreneurship Development Cell : E-Cell is a student-run body that aims to promote entrepreneurship by conducting workshops, speaker sessions, and discussions on business and its aspects. The organization possesses a mentor board to help startups grow.
5. Frequency Club Team : This team contributes to both software and hardware domains, mainly focusing on Artificial Intelligence, Machine Learning, and its advances.
6. Team Garuda : Design and development of a supermileage urban concept electric car. Indigenous development of E-mobility products.
7. Team Jatayu : Aims to build a low-cost Unmanned Aerial Vehicle capable of autonomous navigation, obstacle avoidance, object detection, localization, classification, and air drop of a package of optimum weight.
8. Solar Car : Aims to build a roadworthy solar electric vehicle to contribute to a green and sustainable environment.
9. Team Antariksh : A Space Technology Student Club whose goal is to understand, disseminate, and apply engineering skills for innovation in the field of Space technology, including the development of operational rockets of various altitude platforms.
10. Team Chimera : Building a Formula Electric Car through research and development in E-Mobility.Electrifying Formula Racing.
11. Helios Racing Team : Involved in the design, manufacturing, and testing of All-Terrain Vehicles and other supportive tasks for the functioning of the team. Participating in BAJA competitions organized by SAE in India and the USA.
12. Team Hydra : Developing autonomous underwater vehicles for various real-world applications such as water purification, solid waste detection and disposal, etc.
13. Team Krushi : Aims to develop low-cost equipment to help farmers in cultivating and harvesting. Uses new technology applications to reduce labor time and cost for farmers. Aims at developing implements for tractors.
14. Team Vyoma : Design, fabrication, and testing of radio-controlled aircraft and research on various types of unmanned aerial vehicles.
15. Team Dhruva : Organizing activities like quizzes based on astronomy, stargazing, and telescope handling sessions. Construction of a standard observatory and working on small projects with organizations like ICTS, IIA, ARIES, etc.
16. Ham Club : To popularize Amateur Radio as a hobby among students, alongside exploring technical innovations in the communications domain. Intended to provide human capital for service to the nation during times of natural calamities.

Cultural Activity Teams

1. AALAP (Music club)
2. DEBSOC (Debating society)
3. CARV (Dramatics club)
4. FOOTPRINTS (Dance club)
5. QUIZCORP (Quizzing society)
6. ROTARACT (Social welfare club)
7. RAAG (Youth club)
8. EVOKE (Fashion team)
9. f/6.3 (Photography club)
10. CARV ACCESS (Film-making

NSS of RVCE

NCC of RVCE

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

- To deliver outcome based Quality education, emphasizing on experientiallearning with the state of the art infrastructure.
- To create a conducive environment for interdisciplinary research and innovation.
- To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
- To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
- To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation