Go, Change the world®

RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Scheme and Syllabus of I – IV semester

(Autonomous System of 2022 Scheme)

Master of Technology (M. Tech.)

in

HIGHWAY TECHNOLOGY (MHT)

DEPARTMENT OF CIVIL ENGINEERING

Academic Year 2022-23

Estd.1963

Go, change the world

RV COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to VTU, Belagavi)
RV Vidyaniketan Post, 8th Mile, Mysuru Road, Bengaluru - 560 059.

2022 Ranked 89th in Engineering Category

One of the most preferred Technical Institutions

Accredited by NBA

PROGRAMS OFFERED

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

Five RVCE Alumni cleared Civil Services Exam in 2020-21

Ranked in top 10 Pvt. College in the Country by various magazines

Ranked 3rd in Sports & Cultural Activities under VTU (2019-20)

Use of ICT in Teaching Learning Process

e-Journals e-books | QEE 48 Courses | SWAYAM | NPTEL 9,300+ Enrolled 68th place in the country (Jul-Oct-2019) | Wikispace | MOOCS | MODULE

Conference Publications 1325
Journal Publicatons 1020
Patents Filed 55
Patents Publised 48
Patents Granted 16

Holistic development of students through NCC, NSS Cultural activities, Community service & Sports.

16 Centres of Excellences
07 Centres of Competence

MoUs: 90+with Industries / Academic Institutions in India & abroad

Executed more than Rs. 40 crores worth sponsored research projects & consultancy works sicnce 3 years

UPSC Results (2020): RVCE-Alumni

Name : Kushal Jain
Rank : 40
ISE-2016 Pass out

Name : Naveen Kumar
Rank : 62
ME - Pass out

Name : Deepak R. Shet
Rank : 311
ECE – 2013 Pass out

Human Resource

Faculty with Industrial experience 104
Visiting Adjunct Faculty 05
Total Number of Faculty 347
Faculty with Ph.D. Qualification 240
Faculty Pursuing Ph.D. 87
Technical & Admin Staff 221

RVCE - Greaves Cotton Ltd Centre of excellence in e-mobility

RV-Mercedes Benz Centre for Automotive Mechatronics

THE World University Rankings 2023

World University Rankings	1501+
Subject Ranking - Engineering	1001+
Subject Ranking - Computer Science	801+

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 **Highway Technology** graduates will be able to:

PO1: Independently carryout research / investigation and development work to solve practical problems related to highway technology

PO2: Write and present a substantial technical report /document in the field of Highway technology

PO3: Demonstrate a degree of mastery over materials, analysis, design, construction, maintenance and management of highways

PO4: Use modern tool for design, analysis and management of highways

PO5: Adopt safe, economical, ethical and sustainable factors in design, construction and management of highways.

PO6: Exhibit multi-disciplinary and management skills with commitment to lifelong learning

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M. Tech in Highway Technology MHT

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	22MAT11AT	Computational Mathematics	3	1	0	**4**	MA	Theory	1.5	100	3	100
2	22MHT12TL	Pavement Materials	3	0	1	**4**	CV	Theory+Lab	1.5	100	3	100
3	22MHT13T	Traffic Engineering and Design	3	1	0	**4**	CV	Theory	1.5	100	3	100
4	22MHT14L	Software Applications in Highway Engineering	1	0	1	**2**	CV	Lab	1.5	50	3	50
5	22MHT1AXT	Elective A (Professional Elective)	3	0	0	**3**	CV	Theory	1.5	100	3	100
6	22MHT1BXT	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)
22MHT1A1T	Geographical Information Systems for Transportation	22MHT1B1T	Highway Geometric Design
22MHT1A2T	Ground Improvement Techniques	22MHT1B2T	Road Safety Engineering
22MHT1A3T	Reinforced Earth Panel Walls	22MHT1B3T	Environmental Impact Assessment for Road Projects

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	22IM21T	Research Methodology	3	0	0	**3**	IM	Theory	1.5	100	3	100
2	22MHT22TL	Pavement Analysis and Design	3	0	1	**4**	CV	Theory+Lab	1.5	100	3	100
3	22MHT23T	Transportation Systems and Planning	3	0	0	**3**	CV	Theory	1.5	100	3	100
4	22MHT2CXT	Elective C (Professional Elective)	3	0	0	**3**	CV	Theory	1.5	100	3	100
5	22XXX2DXXT	Elective D (Global Elective)	3	0	0	**3**	Res. BoS	Theory	1.5	100	3	100
6	22MHT24L	Data Collections and Mapping for Highways	1	0	1	**2**	CV	Lab	1.5	50	3	50
7	22HSS25T	Professional Skills Development-I	2	0	0	**2**	HSS	Theory*	1.5	50	2	50

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Code	Elective C (Professional Elective)
22MST2C1T	Design of Concrete Bridges
22MHT2C2T	Pavement Detoriation and Evaluation
22MHT2C3T	Road Construction Equipments

Elective D (Global Elective)			
22BT2D01T	Bioinspired Engineering	22ET2D08T	Tracking and Navigation Systems
22BT2D02T	Health Informatics	22IM2D09T	Project Management
22CS2D03T	Business Analytics	22IS2D10T	Database and Information Systems
22CV2D04T	Industrial and Occupational Health and Safety	22IS2D11T	Management Information Systems
22CV2D05T	Intelligent Transportation Systems	22MAT2D12T	Statistical and Optimization Methods
22EC2D06T	Electronic System Design	22ME2D13T	Industry 4.0
22EC2D07T	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	22MHT31T	Highway Construction and Maintenance	3	1	0	**4**	CV	Theory	1.5	100	3	100
2	22MHT3EXT	Elective E (Professional Elective)	3	1	0	**4**	CV	Theory	1.5	100	3	100
3	22MHT32N	Internship	0	0	6	**6**	CV	Internship	1.5	50	3	50
4	22MHT33P	Minor Project	0	0	6	**6**	CV	Project	1.5	50	3	50
						20						

Code	Elective E (Professional Elective)
22MHT3E1T	Pavement Management Systems
22MHT3E2T	Highway Economics
22MHT3E3T	Road Project Reports

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	22MHT41P	Major Project	0	0	18	**18**	CV	Project	1.5	100	3	100
2	22HSS42	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	:	22MAT11A	**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 going through this course the student 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

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
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	:	22MHT12TL	**Pavement Materials**	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. Archana M R				

UNIT - I	**9 Hrs**
Soil – types, source, functions, requirements, properties, tests and specifications for use in various components of road. Soil compaction- factors and methods, Alternate and new materials- characteristics and application in highways.	
UNIT - II	**8 Hrs**
Aggregates–Natural and Manufactured Aggregates, Tests and specifications on road aggregates for flexible and rigid pavements. Importance of aggregate gradation, shape factors	
UNIT - III	**9 Hrs**
Bituminous binders and mixes – different types, properties and uses, physical tests on bitumen, Rheological and pavement performance related properties, Modified binders, requirements of ideal pavement binders, characteristics and applications in road construction, criteria for selection of different binders. Bituminous mixes, types, requirements, properties, tests, Marshall Method of mix design, Criteria and super pave mix design, Additives & Modifiers in Bituminous mixes, problems on mix design	
UNIT - IV	**8 Hrs**
Cement and Cement concrete mixes – requirements, design of mix for CC pavement, use of additives, different types of concrete mixes, IRC specifications & Tests, joint filler and sealer materials, special concrete mixes	
UNIT - V	**8 Hrs**
Alternate materials – GGBS, Silica Fumes, construction and demolition waste, flyash, admixture – plasticizers, super plasticizers, retarders, other admixtures.	
LABORATORY	**28 Hrs**
1. Tests on materials i. Penetration on aged binders ii. Viscosity using rotational viscometer iii. Elastic recovery iv. Separation test 2. Tests on mixes v. Bitumen extraction and gradation vi. Mix design by Marshall Method for dense bituminous mixes. vii. Temperature susceptibility and Moisture susceptibility using indirect tensile strength test for bituminous mixes viii. Indirect tensile repeated load tests	

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

CO1	:	Explain properties and requirements of materials and mixes used for pavements
CO2	:	Analyze properties of different materials and mixes used for pavements
CO3	:	Evaluate suitability of different materials and mixes for pavements.
CO4	:	Propose suitable materials and mixes for pavements.

Reference Books

1. Hot Mix Asphalt Materials, mixture design and construction, Freddy L Roberts, Prithvi S Kandhal, Brown, E R, Lee, D-Y, Kennedy, T W, 2nd Edition, National Asphalt Pavement Association Research and Education Foundation, Maryland, USA, ISBN-10: 0914313010

2. Soil Mechanics for Road Engineers- Her Majesty's Stationary Office, 1952 Publication,ISBN 10: 0115502785, ISBN 13: 9780115502781

3. Pavement Analysis and Design, Huang, 2004, Pearson Publications, ISBN-13:9780131424739.

4. Highway Hand Book of Highway Engineering, T F Fwa, September 28, 2005, CRC Press, ISBN 9780849319860

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	:	22MHT13T	**Traffic Engineering and Design**	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. L Durga Prashanth				

UNIT - I	**9 Hrs**
Introduction to Traffic Engineering:Traffic engineering as a profession, Elements of traffic enginering, modern problems for the traffic engineer,Reasons for data collection and frequency of data collection.Traffic components, characteristics of driver, pedestrain, bicyclist, the vehicle and the road. Traffic Engineering Studies:Volume studies and characteristics, speed travel time and delay studies, origin and destination studies, sampling in traffic studies- techniques,theory, accuracy and sample size, Parking Studies.	
UNIT - II	**8 Hrs**
Fundamental principles of traffic flow:Traffic stream parameters- headway, occupancy, capacity, density , flow-density relationship, shockwaves in traffic stream, level of service- highway segments and intersesctions, Equivalency factors, Design service volume.Introduction to queuing theory	
UNIT - III	**8 Hrs**
Intersection design:Classification of intersection - at grade and grade seperated intersections, factors and design principles - at grade and grade seperated intersections. Intersection Control: Concepts of traffic control,conflict pioints at intersection, warrants, signal design elements, data collection, concepts, performance measurements, design of pretimed signals.	
UNIT - IV	**8 Hrs**
Traffic regulation, control and safety: Regulation on vehicles, drivers and traffic flow, Parking studies,Traffic control devices – Types & objectives of markings, signs, signals and islands, delineators.Highway traffic safety-approaches to safety, accident data collection and record system, accident statistics, site analysis and development of counter measures.	
UNIT - V	**9 Hrs**
Traffic management techniques - Local area management. Low cost measures. Various types of medium and long term traffic demand management & measures and their uses, ITS and its applications. Environmental Issues – Air and Noise pollution due to road traffic, measurement, control of environmental deterioration. Management of environmental pollution due to road traffic.	

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

CO1	:	Obtain an understanding of the fundamentals of traffic engineering
CO2	:	learn quantitative techniques to understand and solve basic traffic engineering problems
CO3	:	Apply the principles of traffic engineering to evaluate, analyse and design timing plans for signalised intersection
CO4	:	Demanstrate the capability to assess and recommend suitable measures for safe and efficient management of road traffic flow.

Reference Books

1. Nicholas J. Garber and Lester A. Hoel,Traffic and Highway Engineering,5th edition,CL Engineering,2019, ISBN:978-1337631044
2. R Srinivasa Kumar,Introduction to traffic engineering, South Asian Edition, The Orient Blackswan, 2018, ISBN-978-9386235473
3. Roger P. Roess, Elena S. Prassas and William R. McShane, Traffic Engineering, Fifth Edition,Pearson Education,2019, ISBN- 978-9353434854
4. L R Kadyali,Traffic Engineering and Transportation Planning, , Khanna Publishers, 2016, ISBN

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

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
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	:	22MHT14L	**Software Applications in Highway Engineering**	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:		Dr. Archana M R / Dr. Sunil S				

Content	**28 Hrs**

The following algorithms will be executed using Matlab and Python language

1. Introduction to basic tools of coding language
2. Application of coding in pavement engineering
3. Developing an algorithm to interpret the current scenarios on road projects.
4. Application of coding for performance prediction models in pavement engineering
5. Application of coding for Pavement layer moduli prediction and analysis for highways
6. Analysis and prediction of moduli and performance for alternate Pavement composition

Course Outcomes:

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

CO1	:	Understand the coding language for pavement engineering
CO2	:	Design the algorithms for pavement analysis
CO3	:	Develop the algorithms for pavement performance modelling
CO4	:	Validation of the algorithms for pavement analysis, performance and modelling

Reference Books

1. Sherif Sakr, Albert Y. Zomaya, Encyclopedia of Big Data Technologies, ISBN: 978-3-319-77525-8, 2019
2. Matlab An introduction with applications, Amos Gilat, Wiley Publications, ISBN-13: 978-8126537204, 4th edi
3. Vittorio Lora, Python for Civil and Structural Engineers, ISBN 10. 1698951019, 30 September 2019
4. Getting started with MatLab ,Rudra Pratap, 2010,Oxford University Press, ISBN: -13:978-0-19-806919-5

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	:	22MHT1A1T	**Geographical Information Systems for Transportation**	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. Ramthilak				

UNIT - I	**8 Hrs**
Introduction to GIS: Basic Concept and Components – Hardware, Software – Data Spatial and non-spatial –Geo-referencing – Map Projection – Typ es of Projection – Simple Analysis – Data retrieval and querying	
UNIT - II	**9 Hrs**
Data structures and analysis: Database – Raster and Vector data structures – Data storage – Run length, Chain and Block coding – Vector data sto rage – Topology – GIS Modeling - Raster and Vector data analysis– Buffering and overlaying techniques – Network Analysis – Spatial Analysis	
UNIT - III	**8 Hrs**
Shortest Paths and Routing: Fundamental network properties, fundamental properties of algorithms, Shortest Path Algorithms - Generic shortest path algorithm, Dijkstra's algorithm, A* algorithm (Concepts and numericals) Routing vehicles within networks: The Traveling salesman problem (concept and numericals), Vehicle routing problems (Only concepts, no numericals)	
UNIT - IV	**8 Hrs**
Network Flows and Facility Location: Flow through uncongested networks - Minimum cost flow problem - Transportation problem and maximum flow problem (concepts and numericals), Flow through congested networks (Concepts, no numericals) Facility location within networks: Median problems, centers problem and requirements problems (Concepts, no numericals)	
UNIT - V	**9 Hrs**
Intelligent Transportaion Systems: ITS Development, ITS Architectures - Case studies from US, Japan and Europe, Integrating GIS and ITS - In-vehicle navigation systems, Advanced Traveler Information Systems, Advanced Vehicle Location Systems, ITS Applications - Travel and Transportation managment, Travel demand management, Public transportation operations, Electronic payment systems, Commercial vehicle operations, Emergency managment, Advanced vehicle control and safety systems	

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

CO1	:	Apply principles of GIS in Raster and Vector Analysis
CO2	:	Analyze various network problems
CO3	:	Evaluate different types of flow through networks
CO4	:	Demonstrate the application of GIS and ITS in Transportation

Reference Books

1. Principles of Geographical Information System, Burrough P A, 1998, Oxford Publication
2. Concepts and Techniques of Geographic Information System, Lo C P &Yeung A K W, 2006, Prentice Hall of India, New Delhi
3. Remote Sensing and Geographical Information Systems, Anji Reddy M, 2001, B S Publications, Hyderabad
4. Getting started with Geographical Information Systems, Clarke K ,2002, John Wiley & Sons, New York

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	:	22MHT1A2T	**Ground Improvement Techniques**	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. M S Nagakumar				

UNIT - I	**9 Hrs**
Ground Improvement: Introduction to soil improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. Grouting: Introduction, Effects of grouting, Chemicals and materials used, Types of grouting, Grouting procedure, Applications of grouting	
UNIT - II	**9 Hrs**
Mechanical Modification: Type of mechanical-modification, Aim of modification, compaction, Principle of modification for various types of soils, Effect of grain size distribution on compaction for various soil types like BC soil. Lateritic soil, coarse-grained soil, micaceous soil, Field compaction - static, dynamic, impact and vibratory type, Specification of compaction	
UNIT - III	**8 Hrs**
Hydraulic Modification: principle, techniques, gravity drain, lowering of water table, multistage well point, vacuum dewatering, discharge equations, design of dewatering system including pipe line effects of dewatering. Drainage of slopes, preloading, vertical drains, sand drains.	
UNIT - IV	**8 Hrs**
Chemical Modification: Special effects, and methods. Techniques, admixtures, stabilization. hydration -effect of cement stabilization on permeability, Swelling and shrinkage. Criteria for cement stabilization, Artificial neural network model for determining the strength of soil –cement mixtures	
UNIT - V	**8 Hrs**
Geosynthetics: Introduction, Soil reinforcement, Properties of geosynthetics, Applications of geosynthetics, Soil nailing technique	

Course Outcomes:

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

CO1	:	Describe the in-situ methods of soil improvement
CO2	:	Acquire knowledge of ground improvement methods and its application
CO3	:	Analyze the behavior of soil with the ground improvement methods
CO4	:	Summarize the methods of stabilization and its suitability for various problematic soils

Reference Books

1. Purushothama Raj. P. Ground Improvement Techniques Firewall Media Publisher, 2004 ISBN8170088372

2. G. L. Shivkumar Babu An introduction to soil reinforcement and geosynthetics, Universities Press (India) Pvt. Ltd. ISBN9788173718489

3. Manfied Hausmann Engineering principles of ground modification, McGraw Hill Pub. Co., New York.,2008 ISBN0070272794

4. Bell, F.G. Methods of treatment of unstable ground, Butterworths, London. 2007 ISBN0408001666

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	:	22MHT1A3T	**Reinforced Earth Panel Walls**	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. M S Nagakumar				

UNIT - I	**8 Hrs**
Earth Pressure Theories : Introduction – State of stress in retained soil mass – Earth pressure theories –Classical and graphical techniques – Active and passive cases – Earth pressure due to external loads, empirical methods, Wall movement	
UNIT - II	**9 Hrs**
Compaction, Drainage and Stability of retaining Structures Retaining structure – Selection of soil parameters , Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. Earth pressure due to earthquake forces , Stability of retaining structure	
UNIT - III	**8 Hrs**
Sheet Pile Walls Retaining structure – Selection of soil parameters – Analysis and design of cantilever and anchored sheet pile walls. Dead man and continuous anchor. Diaphragm and bored pile walls – Design requirements	
UNIT - IV	**8 Hrs**
Supported Excavations Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos ,Soil anchors, Soil pinning , Soil nailing – Basic design concepts	
UNIT - V	**9 Hrs**
Design Of Reinforced Earth Retaining Wall Reinforced earth retaining wall – principles, Concepts and mechanism of reinforced Earth – Design consideration of reinforced earth – Materials used in reinforced earth - Geotextile – Geogrids, Metal strips, facing elements.	

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

CO1	:	Enumerate the types of earth retention system
CO2	:	Predict the Suitability of earth system for a particular project
CO3	:	Quantify the lateral earth pressures associated with different earth systems
CO4	:	Select the most technically appropriate and cost-effective type of retaining wall for the application

Reference Books

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

Scheme of Continuous Internal Evaluation (CIE): 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	:	22MHT1B1T	**Highway Geometric Design**	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. Anjaneyappa				

UNIT - I	**8 Hrs**
Introduction: Importance, Factors governing geometric design, route selection,, geometric design consistency, capacity of rural and urban roads, Cross Section Elements: Right of way and width consideration, roadway, shoulders, kerbs, traffic barriers, medians, service roads, pavement surface characteristics, cross slope ,skid resistance, unevenness,	
UNIT - II	**9 Hrs**
Geometric Design Elements: Sight distances-SSD, ISD, OSD, factors governing sight distances, Design of horizontal alignment-overturning and skidding, super elevation, extra widening, transition curves, Design of vertical alignment – gradient, vertical curves	
UNIT - III	**8 Hrs**
Intersection Design : At grade intersections – sight distance consideration and principles of design, Channelization, mini round – about, layout of round – about, Inter – Changes – major and minor interchanges, entrance and exit ramps, acceleration and deceleration lanes	
UNIT - IV	**9 Hrs**
Road way facilities and Road safety Furniture: Pedestrian facilities, busbay, truck lay bays, frontage roads, parking areas, cattle crossings, lighting, toll plazas, operation and maintenance centre, landscaping and tree plantation, Road Safety furniture- signage, markings, road humps, speed calming measure	
UNIT - V	**8 Hrs**
Road accidents, Trends, causes,Collision and Condition diagrams,, Road Safety Audits,Mitigation Measures, Black spots	

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

CO1	:	Explain the geometrical design elements.
CO2	:	Plan the geometric elements for varying conditions of roads.
CO3	:	Examine the geometric elements and propose appropriate geometry
CO4	:	Examine and design mitigative measures for safety

Reference Books

1. A Policy on Geometric Design of Highways and Streets, (The Green Book) 6th Edition, American Association of State Highway and Transportation Officials (AASHTO) Publishers, 2011,ISBN Number: 978-1-56051-508-1.

2. Khanna S.K, Justo CEG, Veeraragavan A “Highway Engineering” Khanna Publishers, 10th Edition, 2015,ISBN: 9788185240800

3. John G Schoon “Geometric design projects for Highways: An Introduction” 2nd Edition, American Society of Civil Engineers Press, ISBN: 978-0-7844-7042-8, 2000.

4. Relevant Indian Roads Congress Code Books(IRC) IRC011-1962,IRC012-2009,IRC032-1969,IRC064-1990,IRC066-1976,IRC073-1990,IRC080-1981,IRC086-1983,ITC092-1985,IRCSP023-1993.,IRCSP88 2010,IRCSP99 2013.Publisher Indian Roads Congress, New Delhi.

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	:	22MHT1B2T	**Road Safety Engineering**	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. Anjaneyappa				

UNIT - I	**8 Hrs**
Introduction to safety Road accidents, Trends, causes, , Highway safety, human factors, Vehicle factors Road Safety, systems approach to safety, road safety improvement strategies, elements of a road safety plan, Safety Data Needs.	
UNIT - II	**8 Hrs**
Data Collection and analysis Collision and Condition diagrams, Analysis of Crash Data: Before-after methods in crash analysis, Black Spot Identification & Investigations, Case Studies.	
UNIT - III	**9 Hrs**
Road Safety Audits Key elements of a road safety audit, Road Safety Audits & Investigations, Describe methods for identifying hazardous road locations, Case Studies.	
UNIT - IV	**9 Hrs**
Crash Reconstruction Concepts of crash reconstruction interpretation of data obtained from the roadway surface, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.	
UNIT - V	**8 Hrs**
Mitigation Measures Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety.	

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

CO1	:	Explain the various aspects of road safety.
CO2	:	Identify the factors affecting road safety.
CO3	:	Examine the engineering factors for safety
CO4	:	Recommend and design mitigative measures for safety.

Reference Books

1. IRC SP 088:The manual on'Road SafetyAudit',Indian Road Congress, New Delhi.
2. Belche Mr, Proctor and Cook P" Practical Road safety auditing", 2nd Edition, 2008,Publishers-Thomas Telford Limited, London, ISBN: 9780727735157
3. Leonard Evans "Traffic Safety", Science Serving Society of Bloomfield Hills, Michigan, 2004,ISBN-10: 0975487108
4. Ezra Hauer," Observational Before-After Studies in Road Safety", Emerald Group

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	:	22MHT1B3T	**Environmental Impact Assessment for Road Projects**	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 S Nagakumar/Dr.Jayanthi.N			

UNIT - I	**8 Hrs**
Concepts, objectives, scope of EIA, EIA Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA and their Roles in the EIA Process; Composition of Expert Committee and International agreements	
UNIT - II	**8 Hrs**
Environmental Legislation and Clearances Key Environmental Regulations : Indian Policies, Constitutional provisions - powers and functions of Central and State government, The Environment (Protection) Act 1986, Ministry of Environment and Forest and Climate Change (MOEF&CC) Notifications (EIA Notifications), NHAI Act, Land Acquisition Acts and other relevant Policies/laws and protection acts, and Awareness on World Bank and ADB Environmental Safeguards Legal Frame Work to obtain Clearances : Flow Charts for Environmental Clearance, Forest Clearance, Wild Life Clearance, Coastal Zone Regulations Clearance and PCB Clearances and Permissions to obtain quarrying and borrowing Operations	
UNIT - III	**8 Hrs**
Baseline Studies Baseline Survey and Analysis : Project Categorisation, Environmental attributes - Criteria for the selection of EIA parameters, Base line survey and Socio-economic Survey; Ecologically Sensitive locations; Sensitive receptors, Historical, Archaeological and Cultural Heritages, Baseline Environmental Monitoring and Conceptual approach for addressing Ambient Air Quality and Noise levels with Modelling. Public Consultation : Methods of Public Consultation, Conceptual approach for Analysis and interpretation of public comments/reviews.	
UNIT - IV	**9 Hrs**
Environmental Impact and Risk Assessment with Mitigation Measures Assessment Methods : Brief notes on Ad hoc method, Overlays method, Battelle's Environmental Evaluation System (EES), Checklists method, Matrices method and Networks methods/diagrams. Impact Prediction and Assessment: Potential Environmental Impact prediction and Assessment during Pre-Construction, Construction and Post-Construction Stages – Impact prediction, impact analysis, impact Evaluation and impact communication; Analysis of Positive Environmental Impacts/Project Benefits, Socio-economic Assessment – Conceptual approach for Project impact on Socio-economic life, Indigenous people, Community and Occupational health and Safety; and Impact Rating/Ranking. Mitigation Measures : Provision of Mitigation measures for predicted impacts and Risks on environment such as Air, water, land/Soil, Noise, flora, fauna, ecologically sensitive locations, sensitive receptors, Socio-economic life, health and Safety. Alternatives : Analysis, Evaluation and ranking/rating of Alternatives	
UNIT - V	**9 Hrs**
Environmental Management Plan: EMP overview, Preparation of Monitoring of Environmental Management Action Plan (EMAP) including Identification of Significant or Unacceptable Impacts requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions and responsibilities; Preparation of Environmental Pollution Monitoring Plan (EMoP), Disaster Management Plan (DMP), Emergency Response Plans (ERP), Occupational Health and Safety Assessment (OHSA) Plans and Community Health and Safety Assessment (CHS) Plans, Check lists, Capacity Building for EMP Implementation, Grievance Mechanism, conceptual approach for Public participation / Stake holder Engagement in decision making and mechanisms for conflict management; Information Disclosure; Public Hearing and Guidelines for Preparation of Project Report, Environmental Auditing and Bill of Quantities (BoQ) in bidding contract. Case Studies: Preparation of EIA for developmental projects - Factors to be considered in making assessment decisions for Highway project – Visit to Construction Site/s to study project impacts on Environment, Community and Occupational Health and Safety	

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

CO1	:	Explain the Environmental and Social Legal Framework and Environmental Clearances of Road Projects
CO2	:	Analyze Impact on Air water and Noise for Road Projects
CO3	:	Examine the Prediction and assessment on Environment of Road Projects
CO4	:	Evaluate Environmental Mitigation measures for Road Projects

Reference Books

1. Environmental impact assessment, Canter, L.W:, McGraw-Hill, 1997,ISBM9780070097674
2. Methods of Environmental impact assessment ,Peter Morris & Riki Therivel, Rouledge,2001.ISBN 9780203892909
3. Environmental Assessment, R K Jain, L V Urban, G S Stacey, H E Balbach, Mc Graw Hill Professional, 2001,ISBN 9780070323698
4. IRC SP-1993-2011: Guidelines on Requirements for Environmental clearance of highway projects, Indian Roads Congress, New Delhi

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	:	**22IM21T**	**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	:	22MHT22TL	**Pavement Analysis and Design**	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. Archana M R				

UNIT - I	**8 Hrs**
Pavements-types, functions, choice ,Factors affecting design and performance of flexible and rigid pavements–Pavement design factors, loads–axle load distribution, ESWL,EWL, VDF	
UNIT - II	**8 Hrs**
Subgrade support-CBR and plate bearing tests, Resilient Modulus, fatigue tests, permanent deformation , factors affecting design and performance of highway and airport pavements – pavement material Characteristics, climatic, drainage and environmental factors, their effects and evaluation	
UNIT - III	**8 Hrs**
Stresses and Deflection/strain in flexible pavements: Application of elastic theory, stresses, deflections/strains in single, two and three and multi – layer system, Applications in pavement design. Visco elastic theory	
UNIT - IV	**9 Hrs**
Flexible pavement design: Empirical, mechanistic- empirical and theoretical design approaches, principle, advantages and application. Design steps by CBR method as per IRC 2001 and 2012 , outline of other common design methods such as AASHTO and Asphalt Institute and Shell methods	
UNIT - V	**9 Hrs**
Rigid pavement design: Determination of ESWL, EWL for dual and dual tandem wheel loads in Rigid pavements, General design principle, Stresses in rigid pavements, stresses due to wheel loads and temperature variations, design of cement concrete pavements as per IRC -58-2015 guidelines, KENSLAB, KENLAYER	
LABORATORY	**28 Hrs**
Axle load survey, Transverse distribution studies, commercial vehicle traffic survey, stress analysis, flexible pavement design based on IRC, Shell and AASHTO method, rigid pavement design IRC method	

Reference Books:

1. “Principles of Pavement Design”, Yoder and Witczak, (second edition) 1975, -John Wiley and sons Inc, ISBN : 978-81-265-3072-4
2. “Pavement Analysis and Design”, Huang, 2004–PearsonPublications, ISBN-13:9780131424739.
3. “Design & Performance of Road Pavements”, David Croney, Paul Croney,(Third Edition), 1997, -McGrawhill Book Co. ISBN-13:9780070144514.
4. IRC37-2001, 2012, IRC81-1997,IRC58–2002, 2015.IRC59–1976,IRC101-1988,

Course Outcomes:

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

CO1	:	Explain parameters and methods of pavement design
CO2	:	Analyze the parameters for pavement design
CO3	:	Select suitable parameters for design of pavements
CO4	:	Design flexible and rigid pavements

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: II						
Course Code	:	22MHT23T	**Transportation System and Planning**	CIE Marks	:	100
Credits L-T-P	:	3 - 0 - 0		SEE Marks	:	100
Hours	:	42L	*(Professional Core - 4)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Prof. Varuna M				

UNIT - I	**8 Hrs**
Introduction: Elements in urban transit system, NUTP, MPO plan. Transportation Planning Process: Problem Definition,Land use transportation planning; Systems approach,integration of transport planning, traffic and land use planning, Corridor Management and Preservation.	
UNIT - II	**9 Hrs**
Transportation Surveys: Definition of study area, zoning, various types of surveys and interpretation, travel demand and forecasting. Trip Generation and Distribution: Trip generation - regression, category analysis.Gravity model,calibration of Gravity model,intervening opportunities model, competing opportunities model.	
UNIT - III	**8 Hrs**
Modal Split : Factors affecting modal split; Modal split in transport planning,Trip interchange Modal split model,Disaggregate mode- Choice model,Logit model of mode choice. Traffic Assignment: Description of transport network, route choice behavior. Assignment techniques- All-or-Nothing assignment, multipath traffic assignment, capacity restrained traffic assignment.	
UNIT - IV	**8 Hrs**
Transportation Survey-Types, importance and procedure.Transport Related Land-use Models-Development of Land-use Models,The Lowry Model,Application of Lowry Model.	
UNIT - V	**9 Hrs**
Urban Structure:Types of Urban Structure, Centripetal - Type Urban Structure, Grid-Type Urban Structure, Linear Type Urban Structure.Case Studies: Case studies on metropolitan transportation planning, integration of multimodal transport systems, best practices and emerging technologies in transportation planning.	

Course Outcomes:

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

CO1	:	Explain planning process for an effective transportation system
CO2	:	Compare the characteristics of mass transit system and methods of collecting traffic data to propose an effective transport facility
CO3	:	Calculate zonal trip generation and attraction for inter-zonal trip distribution methods
CO4	:	Evaluate transport system for assigning travel trips to various routes for effective management and economic sustainability

Reference Books

1. L R Kadiyali, Traffic Engineering and Transport Planning,9th Edition, Khanna Publishers, 1999, ISBN 139788174092205

2. Ponnuswamy S and Johnson Victor,Urban Transportation: Planning, Operation and Management,1st Edition,McGraw Hill Education (India) Private Limited,2012,ISBN- 9781259002731.

3. JotinKhisty and Kent Lall B,Transportation Engineering –An Introduction, 3rd Indian Edition, PHI learning New Delhi, 2013, ISBN-13: 978-0130335609

4. Hutchinson, B.G, Principles of Urban Transport System Planning, McGraw-Hill Inc.,US, 1974, ISBN-13: 978-0070315396,1974

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

Sl.No	Content	Marks
1	Quizzes - Q1 & Q2	20
2	Tests - T1 & T2	40
3	Experiential Learning - EL1 & EL2	40
	Total Marks	100

RUBRIC for SEE

Q. No	Contents	Marks
Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
1 & 2	Unit-1: Question 1 or 2	20
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	:	22MST2C1T	**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	:	22MHT2C2T	**Pavement Deterioration and Evaluation**	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. Anjaneyappa				

UNIT - I	**8 Hrs**
Introduction: Structural and functional requirements of flexible and rigid pavements, different types, causes and remedial measures of failures in flexible and rigid pavements.	
UNIT - II	**8 Hrs**
Pavement surface condition evaluation – requirements, Causes, effects, methods of measurement / evaluation and treatment of: Pavement slipperiness, Riding quality and unevenness, Rating techniques, use of modern equipments for equipment for pavement surface condition measurements, analysis of data, interpretation and application	
UNIT - III	**9 Hrs**
Structural evaluation of pavements: requirements, factors affecting structural condition, causes, effects, methods of structural evaluation of flexible pavements by Benkelman beam deflection method, FWD, analysis of data, importance of deflection bowl measurements, interpretation and applications, design of overlay. Use of FWD and other methods for evaluation of flexible and rigid pavements and their application. Problems	
UNIT - IV	**9 Hrs**
Overlay design: as per IRC:81-1997, choice of overlay type and pavement materials over existing flexible and rigid pavements, use of white topping, ultra thin white topping, thin white topping and ICBP as overlays	
UNIT - V	**8 Hrs**
Model pavement studies, pavement testing Under controlled conditions, accelerated testing and evaluation methods. Test track studies. Instrumentation for pavement testing	

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

CO1	:	Explain structural and functional adequacies of flexible and rigid pavements
CO2	:	Analyze functional and structural deterioration of pavements, overlay types, semifield studies
CO3	:	Categorize pavement condition, distress and overlay techniques
CO4	:	Summarize different pavement deterioration and evaluation techniques

Reference Books

1. E.J.Yoder & Witczak M.W. “Principles of Pavement Design”- 2nd Edition – John Willey and Sons Inc., New York, 1975, ISBN: 978-0-471-97780-3

2. Hass R., Hudson. W. R., Zaniewisti .J. “Modern Pavement Management” – Krieger Publishing Company, Florida, 1994, ISBN: 9780070308954

3. William D. 0. Paterson, ‘Road Deterioration and Maintenance Effects, Models for Planning and Management’, The Highway Design and Maintenance Standards series, A World Bank Publication, June 1990, ISBN-10: 0801835909;ISBN-13: 978-0801835902

4. David and Paul Croney, “Design and performance of road pavements”- third edition, Mc Graw hill, 1998, ISBN-10: 0070144516; ISBN-13: 978-0070144514

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	:	22MHT2C3T	**Road Construction Equipment**	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. Anjaneyappa/ Prof. Varuna M			

UNIT - I	**8 Hrs**
Introduction Importance of plants and equipments – advantages and limitations, types of construction equipment used in road construction	
UNIT - II	**8 Hrs**
Equipment for earthwork, hauling and spreading Dozers, excavators, loaders, hauling units, graders – application, types, production, factors effecting the production	
UNIT - III	**9 Hrs**
Plants for productions of aggregates and mixes Crushers- types, factors effecting the production, Pug mill for production wet mix macadam, Hot bituminous mix plants – types, production process, Concrete batching plant- cement concrete production process	
UNIT - IV	**8 Hrs**
Paving and Compacting Equipment Pavers – components, types of pavers, factors influencing paving quality, , Compactors – types, application, Miscellaneous equipment – Kerb casting equipment, road marking equipment, bitumen sprayers	
UNIT - V	**9 Hrs**
Equipment Management Forecasting equipment requirement, maintenance of equipment, selection of construction equipment- task considerations, cost considerations, equipment acquisition options	

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

CO1	:	Explain the broad features of road construction equipment
CO2	:	Select construction equipments for road construction
CO3	:	Evaluate the productivity of the equipments
CO4	:	Optimize the equipment productivity for road construction

Reference Books

1. Peurifoy RL and Clifford JS ‘ Construction Planning Equipment and Method’ (8th Edition) 2010, McGraw Hill Book Co Inc, ISBN:13:978-0073401126.
2. SC Sharma ‘Construction Equipment and its Management’ 2002, Khanna Publishers, ISBN-13:978-8174091376
3. K K Chitkara ‘ Construction project management planning, scheduling and controlling’ (Third Edition) June 2014, Tata Mc Graw hill Publications. ISBN-13: 978-9339205447
4. IRC SP:96-2012, IRC -97-2013, IRC-SP:86:2010, IRC SP:39-1192

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	:	22BT2D01T	**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 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	:	22BT2D02T	**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 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	:	22CS2D03T	**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 .

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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).		
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	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	:	22CV2D04T	**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.

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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.

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Rubric for CIE & SEE Theory courses

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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	:	22CV2D05T	**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
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Rubric for CIE & SEE Theory courses

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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	:	22EC2D06T	**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

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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.

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Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
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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	:	22EC2D07T	**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
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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).		
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3	Experiential Learning - EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
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			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	:	22ET2D08T	**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 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	:	22IM2D09T	**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 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	:	22IS2D10T	**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	:	22IS2D11T	**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.
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	:	22MAT2D12T	**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	:	22ME2D13T	**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 virtual worlds, 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 FIVE full questions selecting ONE from each unit (1 to 5).		
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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	:	22MHT24L	**Data Collections and Mapping for Highways**	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:			Dr. Anjaneyappa/Dr. Archana M R/Dr. Sunil S			

Content	**28 Hrs**
Part A: 1. Fundamentals of DGPS Instruments 2. Setting up of Instrument 3. Conducting Longitudinal Section Survey using DGPS 4. Conducting Cross Section Survey using DGPS 5. Conducting Topographical Survey for Green field Highway Project 6. Downloading the data from DGPS Data and Preparation of Topographical drawings using AutoCAD Part B: 1. Introduction to Highway design Package 2. Preparation of Alignment Plan 3. Generation of Existing Cross Section and Longitudinal Section 4. Designing Horizontal and Vertical Alignments 5. Preparation of BOQ	

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

CO1	:	Apply advanced surveying equipment for data collection for road projects
CO2	:	Extract data and plot topographical drawings
CO3	:	Design horizontal and vertical alignment using AutoCad
CO4	:	Generate plan, longitudinal and cross sectional drawings using AutoCAD

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	:	**22HSS25T**	**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	:	22MHT31T	**Highway Construction and Maintenance**	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. Anjaneyappa				

UNIT - I	**8 Hrs**
Plants and Equipments: Components of pavement structure, functions and requirements, Plants and Equipments: Excavators, graders, compactors, crushers, bituminous hot mix plants, cement concrete mixers, pavers - uses in road construction	
UNIT - II	**9 Hrs**
Construction of Subgrade and Subbase: Specifications and steps for construction of subgrade, subbase, quality control tests Construction of granular layers: Specifications and steps of construction , WBM, WMM, CRM, quality control tests Construction of Bituminous Layers: Different types of bituminous layers, specifications and construction of bituminous layers, quality control tests	
UNIT - III	**9 Hrs**
Construction of Cement Concrete Pavements: Specifications and steps for construction of DLC, Paving Quality Concrete pavements, quality control tests Specifications and steps for construction of White topping, Interlocking concrete block pavements, quality control tests Safety during Construction: Safety aspects during construction and maintenance works, road safety furniture	
UNIT - IV	**8 Hrs**
Drainage: Assessment of drainage requirements for the road, design of various drainage components, drainage materials, surface and sub surface drainage system for roads, drainage of urban roads	
UNIT - V	**8 Hrs**
Maintenance: Routine and periodic maintenance, preventive and reactive maintenance for drainage and pavements, Preparation of existing pavement for patching, profile correction, special measures to deal with reflection cracks in pavement overlays, requirements for rehabilitation, recycling.	

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

CO1	:	Explain the specifications and steps for construction of Embankment, subgrade, subbase, granular, Bituminous and concrete layers
CO2	:	Select the specifications for construction and maintenance of pavement layers.
CO3	:	Examine the quality of pavement layers during construction and maintenance
CO4	:	Construct and maintain the pavements.

Reference Books

1. MoRTH 'Specifications for Road and Bridge works' 2013, fifth revision, Indian roads Congress, New Delhi

2. Construction Planning, Equipment, and Methods: Robert L.Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, 2013 McGraw-Hill, ISBN-13: 978-0073401126

3. Freddy L Roberts, Prithvi S kandhal et.al 'Hot Mix Asphalt Materials, Mixture Design and Construction'(2nd Edition) National Asphalt Pavement Association, Research and Education Foundation, Maryland, USA , ISBN-10: 0914313010

4. IRC :15-2011, IRC :14-2004, IRC :35-2015, IRC:67-2012, IRC:109-2015, IRC:111-2009, IRC:120 -2015, IRC:SP:11-1984, IRC:SP:42-2014, IRC:SP:50-2013, IRC :SP: 6-2004, IRC:SP:68-2005, IRC:SP:76-2015,

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	:	22MHT3E1T	**Pavement Management Systems**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*Elective E (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Archana M R				

UNIT - I	**8 Hrs**
Introduction: components and principles of pavement management systems, pavement maintenance measures,planning investment, research management Pavement performance evaluation: general concepts, serviceability, pavement distress survey systems, performance evaluation	
UNIT - II	**9 Hrs**
Pavement Performance Prediction: concepts, modeling techniques, structural condition deterioration models, mechanistic and empirical models, HDM and other models, comparison of different deterioration models. Functional condition deterioration models, unevenness prediction models and other models, comparison. Modeling in rehabilitation, budget planning, problems.	
UNIT - III	**9 Hrs**
Design alternatives and selection: Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, reliability concepts in pavement engineering, life cycles costing, analysis of alternate pavement strategies based on distress and performance and problems.	
UNIT - IV	**8 Hrs**
Ranking and optimization methodologies: recent developments, sample size selection, economic optimization of pavement maintenance and rehabilitation.Expert Systems in Pavement Management: applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge-based expert systems.	
UNIT - V	**8 Hrs**
Implementation and application of Pavement Management Systems.- Introduction-major steps-Maintenance Management. and Scheduling, case studies	

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

CO1	:	Explain the need of PMS in planning and maintaining the pavements
CO2	:	Analyse the performance of pavements, causes of failure, rating methods
CO3	:	Evaluate the of models for pavement management.
CO4	:	Develop the PMS for different levels

Reference Books

1. Pavement Management System, Ralph Haas and Ronald W. Hudson, McGraw Hill Book Co. 1978, ISBN. 0070253919

2. Modern Pavement Management Ralph Haas, Ronald Hudson Zanieswki., Kreiger Publications, New York, 1992, ISBN, 0894645889, 9780894645884

3. Proceedings of International Conference on Structural Design of Asphalt Pavements NCHRP, TRR and TRB Special Reports, USA, 2006

4. Pavement Analysis, Per Ulitz , Elsevier Amsterdam, ISBN: 0-620-22376-6

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	:	22MHT3E2T	**Highway Economics**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*Elective E (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Archana M R				

UNIT - I	**8 Hrs**
Introduction- Principle, supply and demand models, equilibrium, sensitivity of travel demand, Elasticities– types, models (Kraft demand model) consumer surplus cost – cost elasticity pricing and subsidy policies, rates of interest, Vehicle operation cost, direct and indirect benefits due to road improvement, Total transportation cost, fixed and variable costs. Road user cost studies in India	
UNIT - II	**9 Hrs**
Economic analysis- Different methods, determination of annual cost, benefit cost ratio, IRR, FYRR, NPV. Sensitivity of economic analysis, Examples of economic analysis for different types of road improvement measures, pavement options, construction of bypasses and upgrading of intersections. Project priorities, methods of dealing with uncertainties	
UNIT - III	**8 Hrs**
Financing of road projects- Methods, Public Private Partnership(PPP), environmental economics, Toll collection, economic viability PPP projects, risk analysis, case studies	
UNIT - IV	**8 Hrs**
Life cycle cost analysis – Introduction, notation, simple and compound interest, uniform series of payments, uniform continuous cash flow and capitalized cost, discrete compound interest factors	
UNIT - V	**9 Hrs**
Application of probability and statistics – Introduction, data analysis and evaluation, sampling, significance testing, regression analysis, queing models.	

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

CO1	:	Explain the principles of highway economics and finance.
CO2	:	Solve the highway projects for varying techno – economical conditions.
CO3	:	Compare economical and financial feasibility for different alternatives of highway projects
CO4	:	Justify techno-economic feasibility of highway projects

Reference Books

1. Transportation Economics, McCarthy, 2001, P ,Blackwell, ISBN: 978-0-631-22180-7.
2. Transportation Engineering an Introduction, JotinChisty.C and Kent Lall,B Prentice – hall of India Private limited, New Delhi, ISBN-81-203-2212-6
3. Manual on economic analysis of highway projects, special publication – 30, New Delhi , 2007, Indian Roads Congress,.
4. Manual for road investment decision model, special publication – 38, New Delhi, 1992, Indian Roads Congress

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	:	22MHT3E3T	**Road Project Reports**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0		SEE Marks	:	100
Hours	:	42L + 28T	*Elective E (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Anjaneyappa				

UNIT - I	**8 Hrs**
Road Project Reports: Salient features of ongoing road projects in India, Objects and Scope of Prefeasibility, feasibility and detailed project report for road projects, typical HR structure for preparation of project reports and implementation of road projects, key acts related road projects	
UNIT - II	**8 Hrs**
Surveys and Investigations for Road Improvement Projects: Traffic surveys and forecasting, topographical surveys, geotechnical and material surveys, Pavement surveys and investigations, Cross drainage structure and drainage surveys, Interpretation of survey results	
UNIT - III	**9 Hrs**
Geometric Design and General elements: Geometrical elements of rural and urban roads – cross sectional elements, horizontal and vertical alignment, Intersections-requirements, capacity of roads Road way facilities: pedestrian facilities, bus bays, truck lay byes, traffic, medical and vehicle rescue aid posts, street lighting, Road safety audit, road safety furniture, Mx Roads	
UNIT - IV	**8 Hrs**
Environmental Impact Assessment: Objectives, procedure of environmental impact assessment, socio economic survey, mitigation measures, Landscaping and tree plantation, implementation of environment management plan, Key environmental legislations, clearances required for road project- environmental, forest, CRZ, wild life, air, noise quality standards	
UNIT - V	**9 Hrs**
Contract Documents and Tender Evaluation : preparation of BOQ, Types of tender documents, salient clauses of tender document, tender evaluation –technical and financial,	

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

CO1	:	Explain the components and need of different types of road project reports.
CO2	:	Choose and execute various surveys and investigations for the road projects
CO3	:	Analyze the surveys and investigations and select geometry of road
CO4	:	Understand the contract document, evaluation and contract management for road projects

Reference Books

1. IRC:SP:19-2001 'Manual for Survey, investigation and Preparation of Road Project' 2001, Indian Roads Congress, New Delhi
2. IRC-73: Guidelines for Geometric Design Standards of Rural Highways, Indian Roads Congress, New Delhi
3. IRC:86: Guidelines for Geometric Design standards of Urban roads, Indian Roads Congress, New Delhi
4. MoRTH 'Model Concession Agreement for Small Road Projects-2000, Indian Road Congress, New Delhi

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	:	22MHT32N	**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	:	22MHT33P	**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	:	22MHT41P	**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.

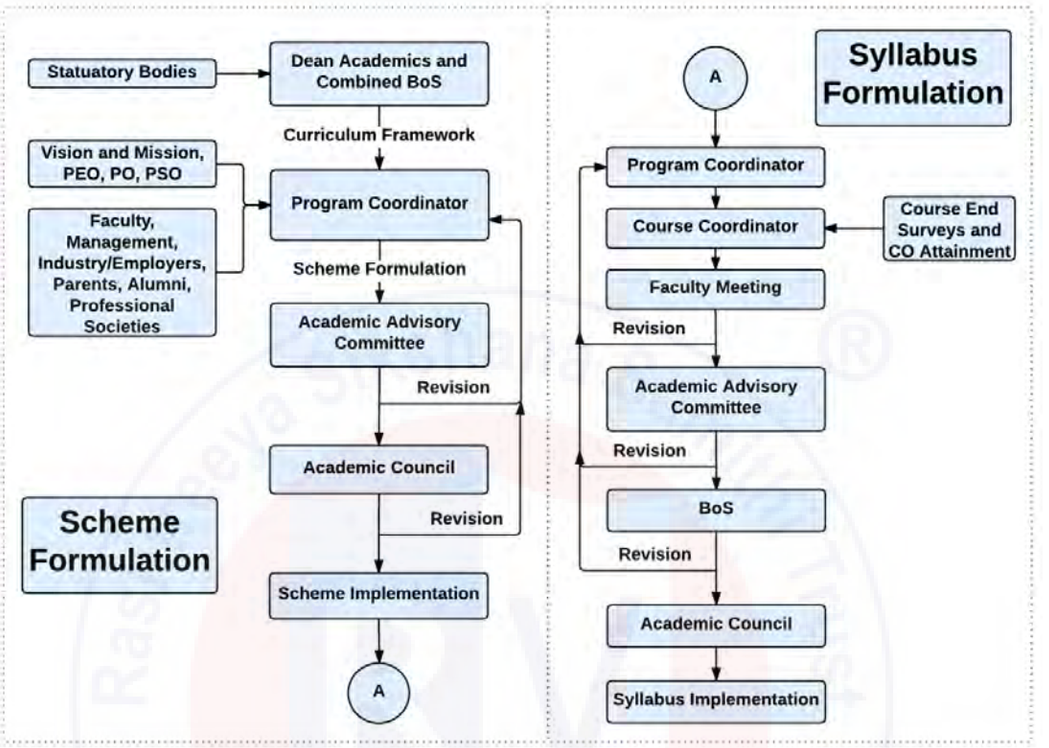
Phase *	Activity	Weightage
I	Selection of Project Title, Formulation of Problem Statement and Objectives	20 %
II	Design, Implementation and Testing	40 %
II	Experimental Result & Analysis, Conclusions and Future Scope of Work, Report Writing and Paper Publication	40 %

* Phase wise rubrics to be prepared by the respective departments

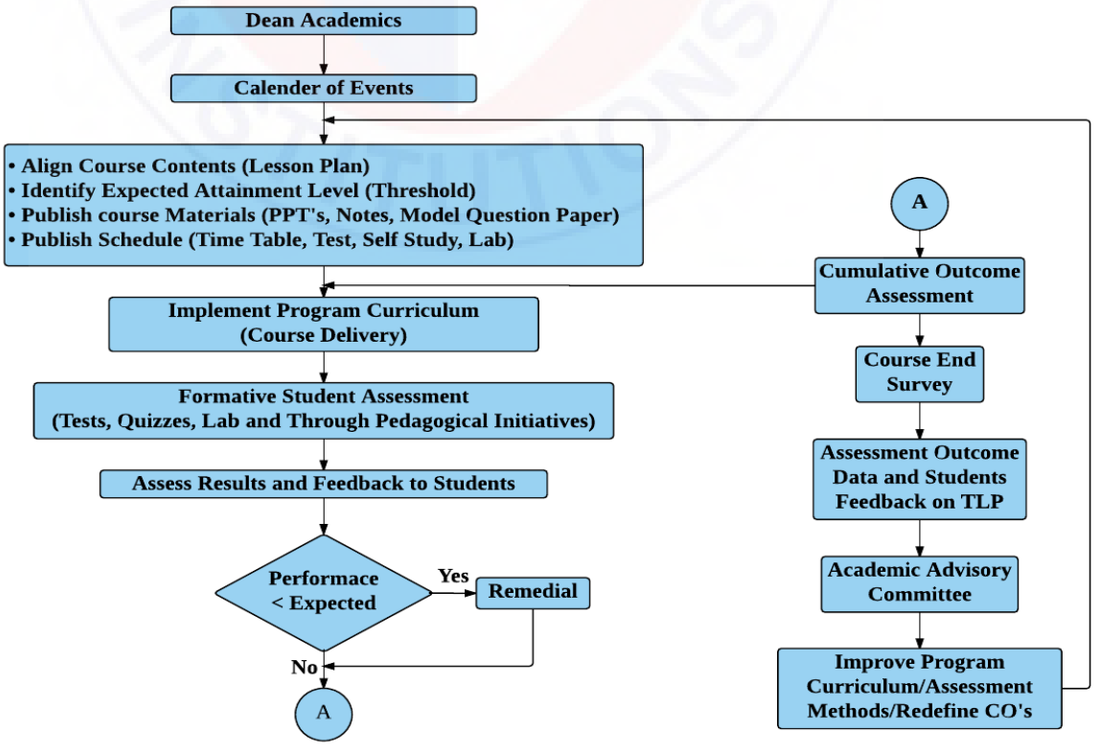
Scheme for Semester End Evaluation (SEE):
Major Project SEE evaluation shall be conducted in two stages. This is initiated after fulfilment of submission of Project Report and CIE marks.
Stage-1 Report Evaluation: Evaluation of Project Report shall be done by the Guide and an External examiner.
Stage-2 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**	

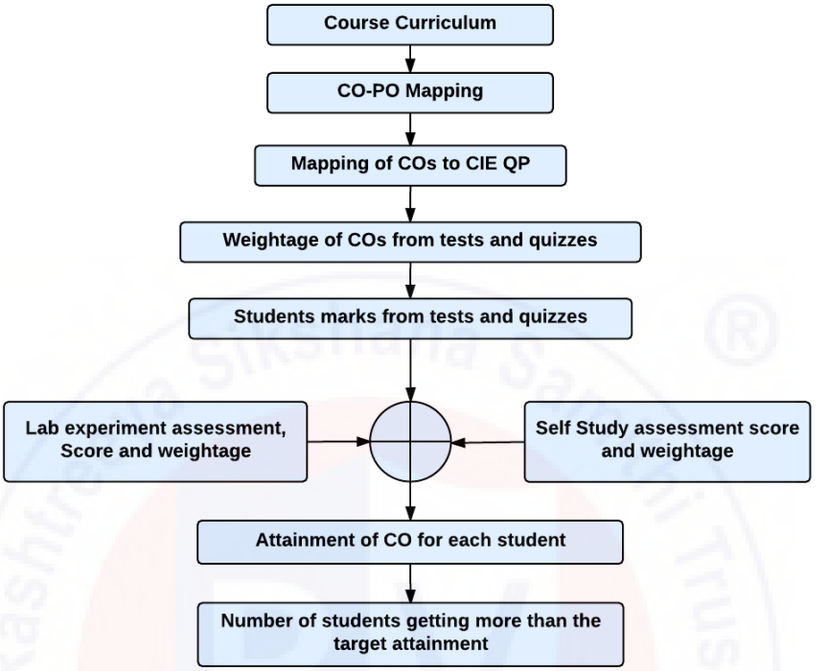
Curriculum Design Process



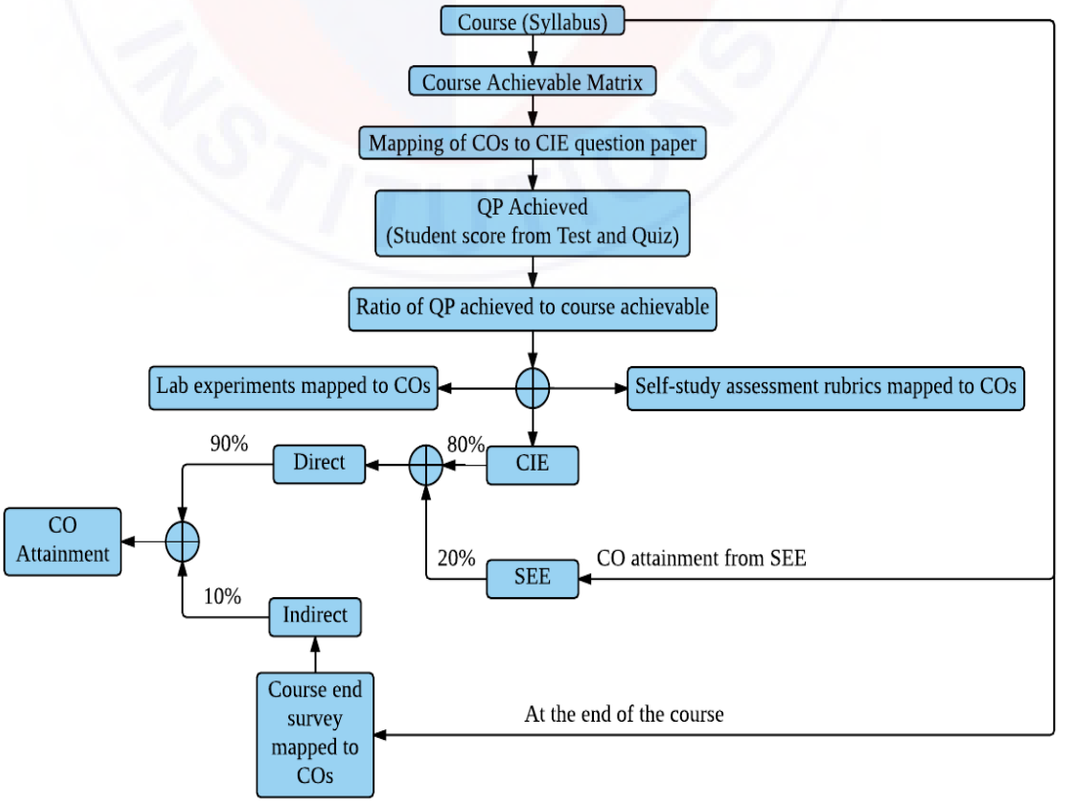
Academic Planning And Implementation



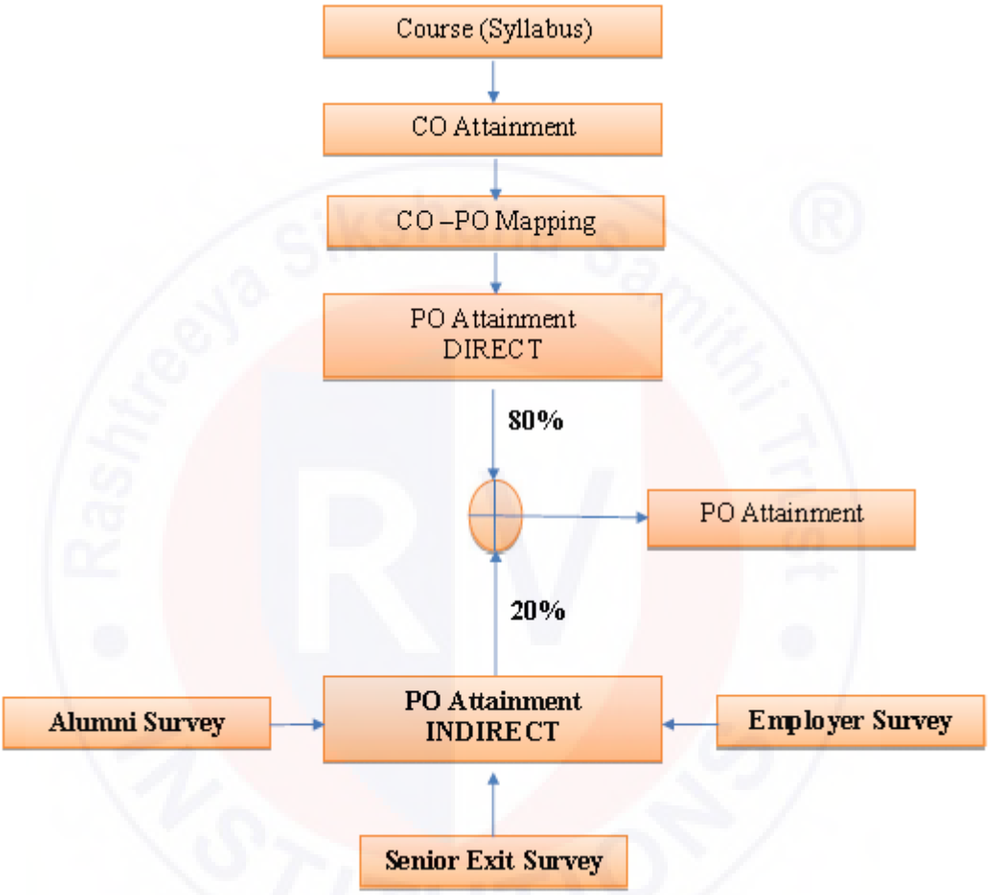
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



Innovative Clubs of RVCE

1	**Ashwa Racing**	Ashwa Mobility Foundation (AMF) is a student R&D platform that designs and fabricates Formula theme race cars and future mobility solutions to tackle urban transportation problems.
2	**Astra Robitcs**	Team involved in the design, fabrication and building application specific robots.
3	**Coding Club**	To facilitate students the skills, confidence, and opportunity to change their world using coding and help them 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. We possess a mentor board to help startups grow.
5	**Frequency Club**	Team aims at contributing in both software and hardware domains mainly focusing on Artificial Intelligence, Machine Learning and it's advances.
6	**Garuda**	Design and development of supermileage urban concept electric car. Indigenous development of E-mobility products.
7	**Jatayu**	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**	Build a roadworthy solar electric vehicle in order to build a green and sustainable environment.
9	**Team Antariksh**	Team Antariksh is a Space Technology Student Club whose goal is to understand, disseminate and apply the engineering skills for innovation in the field of Space technology. designing Nano-Satellite payload for ISRO PS4 Orbital platform, RVSAT-1 along with developing experimental rockets of various altitude.
10	**Team Chimera**	Building a Formula Electric Car through Research and Development in E-Mobility. Electrifying Formula Racing.
11	**Helios Racing**	Team involved in 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 and use it for various real world applications such as water purification, solid waste detection and disposal etc.
13	**Team Krushi**	Develop low cost equipments, which help farmers in cultivating and harvesting the crops. Use new technology applications to reduce the labour time hand cost for farmers. Aims at developing implants for Tractors.
14	**Team vyoma**	Design, fabrication and testing of radio controlled aircrafts 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. 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 at times of natural calamities.

NCC

NCC

एकता और अनुशासन

NSS

राष्ट्रीय सेवा योजना
NATIONAL SERVICE SCHEME

"Not me but you"
" Education through Community Service & Community Service through education"

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 club)**

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 experiential learning 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

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