

*RV College of Engineering®*



# **RV COLLEGE OF ENGINEERING®**

**(Autonomous Institution Affiliated to VTU, Belagavi)**

**R.V. Vidyaniketan Post, Mysore Road**

**Bengaluru – 560 059**



## **Scheme and Syllabus of III & IV Semesters** **(Autonomous System of 2018 Scheme)**

### **Master of Technology (M. Tech)** **in** **HIGHWAY TECHNOLOGY**

### **DEPARTMENT OF** **CIVIL ENGINEERING**

*M.Tech Highway Technology*

**DEPARTMENT OF CIVIL ENGINEERING**

**M.Tech in**

**HIGHWAY TECHNOLOGY**

<b>THIRD SEMESTER CREDIT SCHEME</b>							
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>BoS</b>	<b>Credit Allocation</b>			
				<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
1	18MHT 31	Pavement Deterioration and Evaluation	CV	4	1	0	<b>5</b>
2	18MHT 3EX	Elective -E	CV	4	0	0	<b>4</b>
3	18MHT 33	Internship	CV	0	0	5	<b>5</b>
4	18MHT 34	Dissertation Phase I	CV	0	0	5	<b>5</b>
<b>Total number of Credits</b>				<b>8</b>	<b>1</b>	<b>10</b>	<b>19</b>
<b>Total Number of Hours / Week</b>				<b>8</b>	<b>2</b>	<b>10</b>	

<b>FOURTH SEMESTER CREDIT SCHEME</b>							
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>BoS</b>	<b>Credit Allocation</b>			
				<b>L</b>	<b>T</b>	<b>P</b>	<b>Total Credits</b>
1	18 MHT41	Major Project	CV	0	0	20	<b>20</b>
2	18 MHT42	Technical Seminar	CV	0	0	2	<b>2</b>
<b>Total number of Credits</b>				<b>0</b>	<b>0</b>	<b>22</b>	<b>22</b>
<b>Total Number of Hours / Week</b>				<b>0</b>	<b>0</b>	<b>22</b>	

<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>
		<b>GROUP E: CORE ELECTIVES</b>
1.	18MHT 3E1	Pavement Management Systems.
2.	18MHT 3E2	Environment Impact Assessment of Road Projects
3.	18MHT 3E3	Road Construction Planning and Management

<b>Semester: III</b>		
<b>PAVEMENT DETERIORATION AND EVALUATION</b>		
<b>(Theory)</b>		
<b>Course Code:18MHT 31</b>		<b>CIE Marks:100</b>
<b>Credits: L:T:P : 4:1:0</b>		<b>SEE Marks :100</b>
<b>Hours:48L:12T</b>		<b>SEE Duration:3 Hrs</b>
<b>Course Learning Objectives (CLO):</b> Student will be able to <ol style="list-style-type: none"> <li>1. Discuss structural and functional adequacies of flexible and rigid pavements</li> <li>2. Estimate functional and structural deterioration of pavements, overlay types, semi field studies</li> <li>3. Interpret pavement condition, distress and overlay techniques</li> <li>4. Compare different pavement deterioration and evaluation techniques</li> </ol>		
<b>Unit – I</b>		<b>09Hrs</b>
<b>Introduction:</b> Structural and functional requirements of flexible and rigid pavements, different types, causes and remedial measures of failures in flexible and rigid pavements.		
<b>Unit – II</b>		<b>10Hrs</b>
<b>Pavement surface condition evaluation</b> – 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.		
<b>Unit – III</b>		<b>10Hrs</b>
<b>Structural evaluation of pavements:</b> 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		
<b>Unit – IV</b>		<b>10Hrs</b>
<b>Overlay design:</b> 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		
<b>Unit – V</b>		<b>09Hrs</b>
<b>Model pavement studies,</b> pavement testing Under controlled conditions, accelerated testing and evaluation methods. Test track studies. Instrumentation for pavement testing		
<b>Expected Course Outcomes:</b> After successful completion of this course the student will be able to: <ol style="list-style-type: none"> <li>1. Explain structural and functional adequacies of flexible and rigid pavements</li> <li>2. Analyze functional and structural deterioration of pavements, overlay types, semifield studies</li> <li>3. Categorize pavement condition, distress and overlay techniques</li> <li>4. Summarize different pavement deterioration and evaluation techniques</li> </ol>		
<b>Reference Books:</b>		
1.	Principles of Pavement Design ,E.J.Yoder & Witczak M.W. 2 <sup>nd</sup> Edition – John Willey and Sons Inc., New York, 1975, ISBN: 978-0-471-97780-3	
2.	Modern Pavement Management,Hass R., Hudson. W. R., Zaniewisti .J.– Krieger Publishing Company, Florida, 1994, ISBN: 9780070308954	
3.	Pavement Analysis, Per Ullitz - Elsevier Amsterdam, ISBN: 0-620-22376-6	
4.	Road Deterioration and Maintenance Effects, Models for Planning and Management, William D. O. Paterson, The Highway Design and Maintenance Standards series, A World Bank Publication, June 1990, ISBN-10: 0801835909;ISBN-13: 978-0801835902.	
5.	Design and performance of road pavements, David and Paul Croney, Third edition, Mc Graw hill, 1998, ISBN-10: 0070144516; ISBN-13: 978-0070144514	

**Continuous Internal Evaluation (CIE); Theory (100 Marks)**

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

**Total CIE is  $20+50+30=100$  Marks.**

**Semester End Evaluation (SEE): Total marks: 100**

**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.

<b>PAVEMENT MANAGEMENT SYSTEM(Elective E)</b> <b>(Theory)</b>		
<b>Course Code :18MHT 3E1</b>		<b>CIE Marks: 100</b>
<b>Credits: L:T:P : 4:0:0</b>		<b>SEE Marks: 100</b>
<b>Hours:48</b>		<b>SEE duration : 3 Hrs</b>
<b>Course objectives:</b> This course will enable students to <ol style="list-style-type: none"> <li>1. Understand the need and components of Pavement Management System</li> <li>2. Explain structural and functional evaluation of pavements</li> <li>3. Evaluate pavement distresses for pavement modelling</li> <li>4. Develop a framework for efficient pavement management system</li> </ol>		
<b>Unit – I</b>		
<b>Introduction:</b> components and principles of pavement management systems, pavement maintenance measures, planning investment, research management <b>Pavement performance evaluation:</b> general concepts, serviceability, pavement distress survey systems, performance evaluation		<b>09 Hours</b>
<b>Unit – II</b>		
<b>Pavement Performance Prediction:</b> 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.		<b>10 Hours</b>
<b>Unit – III</b>		
<b>Design alternatives and selection:</b> 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.		<b>10 Hours</b>
<b>Unit – IV</b>		
<b>Ranking and optimization methodologies:</b> recent developments, sample size selection, economic optimization of pavement maintenance and rehabilitation. <b>Expert Systems in Pavement Management:</b> applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge-based expert systems.		<b>10 Hours</b>
<b>Unit – V</b>		
<b>Implementation and application of Pavement Management Systems.-</b> Introduction-major steps-Maintenance Management. and Scheduling, case studies		<b>09 Hours</b>
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Explain the need of PMS in planning and maintaining the pavements.</li> <li>2. Analyse the performance of pavements, causes of failure, rating methods.</li> <li>3. Evaluate the of models for pavement management.</li> <li>4. Develop the PMS for different levels</li> </ol>		
<b>Reference Books:</b>		
<b>1</b>	Pavement Management System, Ralph Haas and Ronald W. Hudson, McGraw Hill Book Co. 1978, ISBN. 0070253919	
<b>2</b>	Modern Pavement Management Ralph Haas, Ronald Hudson Zanieswki., Kreiger Publications, New York, 1992, ISBN, 0894645889, 9780894645884	
<b>3</b>	Pavement Analysis, Per Ulitz , Elsevier Amsterdam, ISBN: 0-620-22376-6	
<b>4</b>	Proceedings of International Conference on Structural Design of Asphalt Pavements NCHRP, TRR and TRB Special Reports, USA, 2006	
<b>5</b>	Models for Planning and Management The Highway Design and Maintenance, William D. O. Paterson, Standards series, A World Bank Publication, June 1990, ISBN-10: 0801835909;ISBN-13: 978-0801835902.	

**Continuous Internal Evaluation (CIE); Theory (100 Marks)**

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

**Total CIE is 20+50+30=100 Marks.**

**Semester End Evaluation (SEE): Total marks: 100**

**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.

<b>ENVIRONMENTAL IMPACT ASSESSMENT OF ROAD PROJECTS(Elective E)</b> <b>(Theory)</b>		
<b>Course Code:18MHT 3E2</b>		<b>CIE Marks:100</b>
<b>Credits :L:T:P: 4:0:0</b>		<b>SEE Marks :100</b>
<b>Credits :48</b>		<b>SEE Duration:03 Hrs</b>
<b>Course Learning Objectives (CLO):</b> Student will be able to 1. Understand the Environmental and Social impacts of Road Projects 2. Apply the Environmental and Social Legal Frame Work. 3. Analyze the Environmental and Social Factors for Clearances. 4. Evaluate , Predict and assess and Incorporate Mitigation Measures		
<b>Unit – I</b>		<b>09Hrs</b>
<b>Introduction:</b> concepts, Objectives, approach for environmental impact studies,, socio economic survey, mitigation measures, clearances required for road projects, Flow chart for obtaining environmental clearance, standards – liquid effluents air quality, noise		
<b>Unit – II</b>		<b>10Hrs</b>
<b>Environmental and Social Legal Framework:</b> Enforcement agencies-MOEF,CPCB, state pollution control boards, Coastal Management regulatory authority, Central ground water board, key environmental legislations- Environmental act, air acts, forest act, wild life protection act, water acts, coastal zone act, key legislations to road projects-national highways acts, NHAI act, land acquisition act, rehabilitation and resettlement policy, building and construction workers welfare act		
<b>Unit – III</b>		<b>10Hrs</b>
<b>Environmental Clearances:</b> General conditions, procedure for obtaining environmental clearances-screening, scoping, public consultation, appraisal, grant or rejection, post environmental clearance monitoring, <b>Forest and CRZ clearance:</b> procedure for obtaining clearance forest ,CRZ , wild lifeclearance, other clearances from – state / central water authority, irrigation/ water resources dept, archeological dept, permission for quarrying and borrowing operations,		
<b>Unit – IV</b>		<b>10Hrs</b>
<b>Prediction and Assessment</b> – impact on air environment, conceptual approach for addressing air environment impact, prediction approach, identification and incorporation of mitigation measures, Impact of noise, conceptual approach for addressing noise environment impact, impact prediction methods, assessment of significance of impacts, mitigation measures		
<b>Unit – V</b>		<b>09Hrs</b>
<b>Socio Economic Assessment :</b> conceptual approach for socio economic impact, traffic impacts, <b>Evaluation of Alternatives:</b> Weighing of decision factors, rating / ranking of alternatives, public participation in decision making, techniques for conflict management		
<b>Expected Course Outcomes:</b> After successful completion of this course the student will be able to: <b>CO1:</b> Explain the Environmental and Social Legal Framework and Environmental Clearances of Road Projects . <b>CO2:</b> Analyze Impact on Air water and Noise for Road Projects . <b>CO3:</b> Examine the Prediction and assessment on Environment of Road Projects <b>CO4:</b> Evaluate Environmental Mitigation measures for Road Projects		
<b>Reference Books:</b>		
1.	Environmental impact assessment, Canter, L.W., McGraw-Hill, 1997	
2.	Methods of Environmental impact assessment ,Peter Morris & Riki Therivel, Roulledge,2001	
3.	Environmental Assessment, R K Jain, L V Urban, G S Stacey, H E Balbach, Mc Graw Hill Professional, 2001	
4.	Highway Impact Assessment, Denver Tolliver, Greenwood publishing group, 1993	

5.	IRC SP-1993-2011: Guidelines on Requirements for Environmental clearance of highway projects, Indian Roads Congress, New Delhi
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**Continuous Internal Evaluation (CIE); Theory (100 Marks)**

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

**Total CIE is 20+50+30=100 Marks.**

**Semester End Evaluation (SEE): Total marks: 100**

**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.



<b>ROAD CONSTRUCTION PLANNING AND MANAGEMENT (Elective E)</b>		
<b>(Theory)</b>		
<b>Course Code:18MHT 3E3</b>		<b>CIE Marks:100</b>
<b>Credits :L:T:P : 4:0:0</b>		<b>SEE Marks :100</b>
<b>Hours :48L</b>		<b>SEE Duration:03 Hrs</b>
<b>Course Learning Objectives (CLO):</b> Graduates shall be able to <ol style="list-style-type: none"> <li>1. Understand the broad features of road construction planning and management.</li> <li>2. Plan the resources for road construction.</li> <li>3. Estimate and analyze the resources required for road construction.</li> <li>4. Formulate the planning and management for road construction</li> </ol>		
<b>Unit – I</b>		<b>10Hrs</b>
<b>Project Management Framework:</b> Types and Scope of highway development projects, project management framework, scope and project objectives, project development process, causes of project failure.		
<b>Unit – II</b>		<b>10Hrs</b>
<b>Project Scheduling:</b> Project work breakdown, determining activities involved, assessment involved, CPM/PERT network analysis, work scheduling, methods of work scheduling, factors affecting work scheduling, optimization. overview of MS project, PRIMAVERA.		
<b>Unit – III</b>		<b>10Hrs</b>
<b>Resource Planning :</b> human resources, project man power grouping, structuring site organisation, construction materials – provisioning process, inventory management, cost and budget planning		
<b>Unit – IV</b>		<b>10Hrs</b>
<b>Construction Equipment:</b> task, cost and engineering considerations,- crushing and mixing plants, rollers, pavers ,equipment acquisition options, selection site for site office, ,		
<b>Unit – V</b>		<b>08Hrs</b>
<b>Planning control system:</b> Resource production, scheduling, codification, project management information system, value management.		
<b>Expected Course Outcomes:</b> After going through this course the student will be able to: <ol style="list-style-type: none"> <li>1. Outline broad features of road construction planning and management.</li> <li>2. Choose appropriate resources for road construction.</li> <li>3. Evaluate the resources required for road construction.</li> <li>4. Propose the planning and management for road construction</li> </ol>		
<b>Reference Books:</b>		
1.	Construction Project Management Planning, Scheduling and Controlling, K K Chitkara, (Third Edition) June 2014, Tata Mc Graw hill Publications. ISBN-13: 978-9339205447.	
2.	Construction Planning Equipment and Method, Peurifoy R L and Clifford J S ‘ (8 <sup>th</sup> Edition) 2010, McGraw Hill Book Co Inc, ISBN:13:978-0073401126.	
3.	Construction Equipment and its Management, S C Sharma ‘2002, Khanna Publishers, ISBN-13:978-8174091376.	
4.	IRC:SP:84-2012, IRC:SP:87-2012, IRC:SP:96-2012, IRC:SP:97-2013	

**Continuous Internal Evaluation (CIE); Theory (100 Marks)**

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

**Total CIE is 20+50+30=100 Marks.**

**Semester End Evaluation (SEE): Total marks: 100**

**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.

INTERNSHIP / INDUSTRIAL TRAINING/INDUSTRIAL VISITS		
Course Code:18MHT33		CIE Marks:100
Credits: L:T:P: 0:0:5		SEE Marks:100
Hours :60		SEE Duration :30 min
GUIDELINES FOR INTERNSHIP		
Course Learning Objectives (CLO): The students shall be able to:		
1	Understand the process of applying engineering knowledge to produce product and provide services.	
2	Explain the importance of management and resource utilization	
3	Comprehend the importance of team work, protection of environment and sustainable solutions.	
4	Imbibe values, professional ethics for lifelong learning.	
<div>1) The duration of the internship shall be for a period of 8 weeks on full time basis between II semester final exams and beginning of III semester.</div> <div>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.</div> <div>3) Internship must be related to the field of specialization or the M.Tech program in which the student has enrolled.</div> <div>4) Students undergoing internship training are advised to use ICT tools such as Skype to report their progress and submission of periodic progress reports to the faculty members.</div> <div>5) Every student has to write and submit his/her own internship report to the designated faculty.</div> <div>6) Students have to make a presentation on their internship activities in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the internship final report. However interim or periodic reports and reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.</div> <div>7) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.</div> <div>8) The broad format of the internship final report shall be as follows<ul style="list-style-type: none"><li>Cover Page</li><li>Certificate from College</li><li>Certificate from Industry / Organization</li><li>Acknowledgement</li><li>Synopsis</li><li>Table of Contents</li><li>Chapter 1 - Profile of the Organization – Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,</li><li>Chapter 2 - Activities of the Department -</li><li>Chapter 3 – Tasks Performed – summaries the tasks performed during 8 week period</li><li>Chapter 4 – Reflections – Highlight specific technical and soft skills that you acquired during internship</li><li>References &amp; Annexure</li></ul></div>		
Course Outcomes: After going through the internship the student will be able to:		
CO1	Apply engineering and management principles	

CO2	Analyze real-time problems and suggest alternate solutions
CO3	Communicate effectively and work in teams
CO4	Imbibe the practice of professional ethics and need for lifelong learning

**Scheme of Continuous Internal Evaluation (CIE):**

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

**Scheme for Semester End Evaluation (SEE):**

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

Explanation of the application of engineering knowledge in industries	<b>35%</b>
Ability to comprehend the functioning of the organization/ departments	<b>20%</b>
Importance of resource management, environment and sustainability	<b>25%</b>
Presentation Skills and Report	<b>20%</b>

**GUIDELINES FOR INDUSTRIAL TRAINING**

**Course Learning Objectives (CLO):**

The students shall be able to:

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

- 1) The duration of industrial training must be for a minimum of 1 week and maximum of 8 weeks on full time basis.
- 2) Industrial Training in which students pays a fee to the organization / industry will not be considered.
- 3) He/she can undergo training in one or more industry /organization.
- 4) The student must submit letters from the industry clearly specifying his / her name and the duration of the training provided by the company with authorized signatures.
- 5) Industrial training must be related to the field of specialization or the M.Tech program in which the student has enrolled.
- 6) Students undergoing industrial training are advised to use ICT tools such as Skype to report their progress and submission of periodic progress reports to the faculty members.
- 7) Every student has to write and submit his/her own industrial training report to the designated faculty.
- 8) Students have to make a presentation on their industrial training in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the final report.
- 9) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
- 10) The broad format of the industrial training report shall be as follows
  - Cover Page
  - Certificate from College
  - Training Certificate from Industry / Organization
  - Acknowledgement
  - Executive Summary
  - Table of Contents
  - Chapter 1 - Profile of the Organization –Organizational structure, Products, Services, Business

Partners, Financials, Manpower, Societal Concerns, Professional Practices <ul style="list-style-type: none"> <li>• Chapter 2 – Details of the Training Modules</li> <li>• Chapter 3 – Reflections – Highlight specific technical and soft skills that you acquired</li> </ul> References & Annexure	
<b>Course Outcomes:</b>  After going through the industrial training the student will be able to:	
CO1:	Understand the process of applying engineering knowledge to solve industrial problems
CO2:	Develop skills through training relevant to industrial requirement
CO3:	Communicate effectively and work in teams
CO4:	Imbibe ethical practices and develop it as life skill.
<b>Scheme of Continuous Internal Evaluation (CIE):</b>  A committee comprising of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:	
<b>Scheme for Semester End Evaluation (SEE):</b>  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.	
Explanation on the application of engineering knowledge	<b>25%</b>
Ability to comprehend the importance of skilling and training	<b>25%</b>
Importance of communication, professional ethics, sustainability	<b>20%</b>
Oral Presentation and Report	<b>30%</b>

<b>GUIDELINES FOR INDUSTRIAL VISITS</b>	
<b>Course Learning Objectives (CLO):</b> The students shall be able to:	
<b>1</b>	Understand the role of industries and service organization in meeting the demands of the society.
<b>2</b>	Explain the working of different industries and organizations with an engineering perspective
<b>3</b>	Comprehend the importance of team work, communication and sustainable solutions.
<b>4</b>	Imbibe values, professional ethics for life long learning.
1) Student must visit a minimum of THREE organizations/industry. The duration of the visit per organization must be for ONE full day, during which he/she must comprehend the importance of organization structure, function of various departments, application of engineering knowledge, resource management, importance to environment and safety, professional ethics. 2) It is mandatory to visit ONE private multi-national company or public sector industry / organization, ONE medium-small enterprise and ONE rural based or NG organization. 3) The student must submit letter from the industry clearly specifying his / her name and the date of visit	

- to the industry with authorized signatures.
- 4) Industrial visit must be related to the field of specialization or the M.Tech program in which the student has enrolled.
  - 5) Every student has to write and submit his/her own report on each industrial visit and submit the report to the designated faculty advisor for evaluation.
  - 6) A photograph outside the industry with the name and logo of the industry in the background along with the students and faculty members could be included in the report.
  - 7) Students have to make a presentation on their industrial visit in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the final report.
  - 8) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
  - 9) The broad format of the industrial visit report shall be as follows
    - Cover Page
    - Certificate from College
    - Acknowledgement
    - Synopsis / Executive Summary
    - Table of Contents
    - Chapter 1 - Profile of the PSU or MNC – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 2 – Profile of the SME – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 3 - Profile of the NGO – must include Organizational structure, services, Manpower, Societal Concerns, Professional Practices
    - Chapter 4 – Comparative Analysis of PSU/MNC – SME – NGO
    - References & Annexure (Permission letters from the organizations for the visit & photographs)

**Course Outcomes:**

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

CO1:	Classify the role of different industries and organization in addressing the needs of the society.
CO2:	Explain the process of applying engineering knowledge in industries and organizations.
CO3:	Describe the importance of communication and team work
CO4:	Recognize the importance of practicing professional ethics and need for life skills.

**Scheme of Continuous Internal Evaluation (CIE):**

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

**Scheme for Semester End Evaluation (SEE):**

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

Explanation of the application of engineering knowledge in industries	<b>25%</b>
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Ability to comprehend the functioning of the organization/ departments	<b>30%</b>
Importance of resource management, environment and sustainability	<b>20%</b>
Presentation Skills and Report	<b>25%</b>

Semester: IV		
MAJOR PROJECT		
Course Code:18MHT 41		CIE Marks:100
Credits: L:T:P: 0:0:20		SEE Marks :100
Hours : 240		SEE Duration:3hrs
<b>Course Learning Objectives:</b> The students shall be able to		
1	Understand the method of applying engineering knowledge to solve specific problems.	
2	Apply engineering and management principles while executing the project	
3	Demonstrate good verbal presentation and technical report writing skills.	
4	Identify and solve complex engineering problems using professionally prescribed standards.	
<b>GUIDELINES</b>		
1. Major project will have to be done by only one student in his/her area of interest.		
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.		
3. Allocation of the guides preferably in accordance with the expertise of the faculty.		
4. The number of projects that a faculty can guide would be limited to three.		
5. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.		
6. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.		
7. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.		
<b>Course Outcomes:</b> After going through this course the students will be able to		
CO1:	Conceptualize, design and implement solutions for specific problems.	
CO2:	Communicate the solutions through presentations and technical reports.	
CO3:	Apply project and resource managements skills, professional ethics, societal concerns	
CO4:	Synthesize self-learning, sustainable solutions and demonstrate life long learning	
<b>Scheme of Continuous Internal Examination (CIE)</b>		
Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.		

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

**CIE Evaluation shall be done with marks distribution as follows:**

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

**Scheme for Semester End Evaluation (SEE):**

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

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



TECHNICAL SEMINAR		
Course Code:18MHT 42		CIE Marks:50
Credits: L:T:P : 0:0:2		SEE Marks:50
Hours :24		SEE Duration:30min
<b>Course Learning Objectives (CLO):</b>		
The students shall be able to:		
1	Understand the technological developments in their chosen field of interest	
2	Explain the scope of work and challenges in the domain area	
3	Analyze these engineering developments in the context of sustainability, societal concerns and project management.	
4	Improve his/her verbal presentation and report writing skills	
GUIDELINES		
<div>1) The presentation will have to be done by individual students.</div> <div>2) The topic of the seminar must be in one of the thrust areas with in-depth review and analysis on a current topic that is relevant to industry or on-going research.</div> <div>3) The topic could be an extension or complementary to the project topic.</div> <div>4) Topics could be in multidisciplinary areas and strongly address the technical design issues.</div> <div>5) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.</div> <div>6) The students must mandatorily address legal, ethical issues as related to the topic of study.</div> <div>7) The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study.</div>		

8) Each student must submit both hard and soft copies of the presentation.

**Course Outcomes:**

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

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

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

**Scheme for Semester End Evaluation (SEE):**

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

**Rubrics for Evaluation:**

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