



**K.E. Society's**  
**Rajarambapu Institute of Technology, Rajaramnagar**  
*(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)*

**M. Tech. Construction Management**  
**Curriculum Structure and Evaluation Scheme (NEP 2020)**  
**To be implemented for 2023-25 & 2024-26 Batch**

Class: F.Y. M. Tech.						Semester: I					
Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min for Passing	40	Max	Min for Passing
CCM 1010	Construction Planning and Scheduling	2	--	--	2	ISE	30	40	40	--	--
						ESE	70	40		--	--
CCM 1030	Construction Equipment	2	--	--	2	ISE	30	40	40	--	--
						ESE	70	40		--	--
CCM 1050	Construction Practices	2	--	--	2	ISE	30	40	40	--	--
						ESE	70	40		--	--
CCM 1070	Quality Assurance and Quality Control in Construction	3	--	--	3	ISE	30	40	40	--	--
						ESE	70	40		--	--
	Program Elective – I	3	--	--	3	ISE	30	40	40	--	--
						ESE	70	40		--	--
	Program Elective – II	3	--	--	3	ISE	30	40	40	--	--
						ESE	70	40		--	--
CCM 1255	Microsoft Project (MSP) Laboratory	--	--	4	2	ISE	--	--	--	50	50
						ESE	--	--		--	50
CCM 1275	Geographic Information System Laboratory	--	--	4	2	ISE	--	--	--	50	50
						ESE	--	--		--	50
SHP 5511	Technical communication	2	--	--	Audit Course	ISE	--	--	--	P/NP	
<b>Total</b>		<b>17</b>	<b>-</b>	<b>8</b>	<b>19</b>						

**Total Contact Hours/Week: 25**

**Total Credit: 19**

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**Program Elective-I**

Sr. No.	Course Code	Course
01	CCM1095	Management Information System
02	CCM1115	Disaster Management
03	CCM1135	Pavement Construction and Management
04	CCM1150	Repair and Rehabilitation of Structures

**Program Elective-II**

Sr. No.	Course Code	Course
01	CCM1175	Bridge Construction
02	CCM1195	Prefabricated Structures
03	CCM1210	Advanced Concrete Technology
04	CCM1235	Construction Waste Management

Department of Civil Engineering



Page 2 of 7



K.E. Society's  
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Class: F.Y. M. Tech.						Semester: II					
Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min for Passing	40	Max	Min for Passing
CCM 1020	Project Economics and Financial Management	2	--	--	2	ISE	30	40	40	--	--
						ESE	70	40		--	--
CCM 1040	Legal Aspects in Construction	2	--	--	2	ISE	30	40	40	--	--
						ESE	70	40		--	--
CCM 1060	Project Formulation and Appraisal	2	--	--	2	ISE	30	40	40	--	--
						ESE	70	40		--	--
	Program Elective III	3	--	--	3	ISE	30	40	40	--	--
						ESE	70	40		--	--
	Program Elective IV	3	--	--	3	ISE	30	40	40	--	--
						ESE	70	40		--	--
CCM 1225	Research Methodology & IPR	2	--	--	2	ISE	50	40	40	--	--
						ESE	50	40		--	--
CCM 1245	Fundamentals of BIM Laboratory	--	--	4	2	ISE	--	--	--	50	50
						ESE	--	--		50	50
CCM 1265	Primavera Laboratory	--	--	4	2	ISE	--	--	--	50	50
						ESE	--	--		50	50
CCM 1285	Mini Project	--	--	4	2	ISE	--	--	--	50	50
SHP 552	Framework of Indian Constitution	2	--	--	Audit Course	ISE	--	--	--	P/NP	
CCM 2015	Industry Internship	--	--	--	Audit Course	ISE	--	--	--	P/NP	
<b>Total</b>		<b>16</b>	<b>--</b>	<b>12</b>	<b>20</b>						

**Total Contact Hours/Week: 28**

**Total Credit: 20**

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\*Note- Student has to complete internship of 2 weeks after 2nd semester however its evaluation will be carried out in 3rd semester.







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**Program Elective-III**

Sr. No.	Course Code	Course
01	CCM1080	Advanced Construction Techniques
02	CCM1105	Health and Safety Management
03	CCM1125	Human Resource Management
04	CCM1145	Shoring, Scaffolding and Form-work

**Program Elective-IV**

Sr. No.	Course Code	Course
01	SHP5261	Probability and Statistics for Engineers
02	CCM1165	Material Management
03	CCM1180	Advanced Construction Materials
04	CCM1200	International Contracting







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**Curriculum Structure and Evaluation Scheme (NEP 2020)**  
**To be implemented for 2023-25 & 2024-26 Batch**

Class: S.Y. M. Tech.						Semester: III				
Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)	
							Max	Min for Passing	Max	Min for Passing
CCM 2015	Industry Internship	--	--	2	Audit Course	ISE	--	--	P/NP	
	Open Elective	3	--	--	3	ESE	100	40	--	--
CCM 2035	Dissertation Phase-I	--	--	8	4	ISE	--	--	100	50
CCM 2055	Dissertation Phase-II	--	--	12	6	ISE	--	--	100	50
						ESE	--	--	100	50
<b>Total</b>		<b>03</b>	<b>--</b>	<b>22</b>	<b>13</b>					

**Total Contact Hours/Week: 25**

**Total Credit: 13**

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**Curriculum Structure and Evaluation Scheme (NEP 2020)**  
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### Open Elective

Sr. No.	Course Code	Course
1.	MOE2011	Artificial Intelligence - Machine Learning
2.	MOE2021	Creative Thinking: Techniques and Tools
3.	MOE2031	MOOC Course
4.	MOE2041	Condition Monitoring and Signal Processing
5.	MOE2051	Aircraft Conceptual Design
6.	MOE2060	Augmented Reality and Virtual Reality
7.	MOE2070	Industrial Instrumentation
8.	MOE2080	Advanced Mechatronics systems

### Note for Open Elective

An Open Elective course is included in the curriculum of S. Y. M. Tech (Semester-III), under which students need to learn either MOOC course or courses offered by department.

#### Guidelines for MOOC course under Open Elective

1. If students opt for MOOC course as an Open Elective, he/she should select this course from NPTEL platform only.
2. As three credits are allotted to open elective, selected MOOC course must be of minimum 6 weeks or 30 hours.
3. Students need to solve assignments given by platform and also, give the final certification exam at allotted NPTEL exam centre.
4. Student must secure certification of NPTEL platform, otherwise he/she will not be eligible for final evaluation.
5. Final evaluation of the MOOC course will be based on oral examination conducted by department and marks secured in the exam conducted by NPTEL.
6. If student fails in NPTEL certification course, he or she should reregister for the course in the next semester.

#### Guidelines for other courses mentioned under Open Elective:

1. Student can opt for courses mentioned in the curriculum.
2. While selecting the course, students must take care that selected course from the list is not learned in UG or PG first year curriculum.
3. Lectures of these courses will be conducted by concerned department faculty by online mode.
4. Evaluation of these courses will be as mentioned in the curriculum.





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Class: S.Y. M. Tech.						Semester: IV				
Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)	
							Max	Min for Passing	Max	Min for Passing
CCM 2025	Dissertation Phase-III	--	--	12	6	ISE	--	--	100	50
CCM 2045	Dissertation Phase-IV	--	--	20	10	ISE	--	--	100	50
						ESE	--	--	100	50
<b>Total</b>		--	--	32	16					

**Total Contact Hours/Week: 32**

**Total Credit: 16**

ISE=In Semester Evaluation, ESE=End Semester Exam, P=Pass, NP=Not Pass

**Total Credits : 19+20+13+16= 68**

**Total Contact Hours: 25+28+25+32= 110**

Department of Civil Engineering



Page 7 of 7





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. Construction Management	Semester: I
Course Code : CCM1010	Course Name: Construction Planning & Scheduling

L	T	P	Credits
2	-	-	2

**Course Description:**

Planning and scheduling of construction project plays important role in construction projects. Development of schedule needs no. of inputs of projects. Here in this course emphasis is given on project planning and scheduling. Critical path method and precedent networking method used for planning & scheduling are discussed. Student will able to determine the time require to complete a project, they also able to update the schedule as per the existing site conditions.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Develop project work breakdown structure.
2. Estimate activity time durations and define scope of project.
3. Prepare and update schedule of a construction project.
4. Analyze resource requirement for a construction project.

**Prerequisite:** Basic knowledge of Construction management

**Course Content**

Unit No.	Description	Hrs
1.	<b>Project Plan:</b> Baseline plan, Requirements, Management, Project deliverables, Project boundaries, Approval and Kickoff, Work breakdown structure.	04
2.	<b>Planning of Scope:</b> WBS dictionary, Task description, Story cards, Writing story cards backlog, Milestone schedule, Gantt chart.	04
3.	<b>Estimating:</b> Estimating techniques-analogous estimates, Bottom up estimates, Three-point estimates using a parametric model, Estimating uncertainty.	04
4.	<b>Project Schedule Techniques:</b> Project scheduling by using CPM, Network updating.	04
5.	<b>PDM:</b> Project scheduling by using precedence diagramming method.	04
6.	<b>Planning of Resources:</b> Resource list, Responsibility matrix, Using contractors and vendors project budget, Resource allocation.	04





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**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- Chitakara K., "Construction Project Management Planning, scheduling and controlling" , McGraw Hill Education India.
- Sengupta B. and H. Guha, "Construction Management and Planning" , McGraw Hill Education India.  
Punmia B. C. & K. K. Khandelwal, "Project Planning and Control with PERT & CPM", Laxmi Publication, New Delhi.

**Reference Books:**

- PMBOK, "A Guide to a Project Management Body of Knowledge", Project Management Institute.
- Srinathan L. S., "PERT AND CPM Principles and Applications", Affiliated east-west press Pvt. Ltd.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: I	L	T	P	Credits
Course Code : CCM1030	Course Name: <b>Construction Equipment</b>	2	-	-	2

**Course Description:**

This subject deals with construction equipment used on construction projects. This course is designed to fulfill the requirements of construction managers to select appropriate equipment based on the construction technique and site condition. Major emphasis in the course is on earthwork operations by using different equipment and equipment performance and management.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Select equipment/plant for particular task.
2. Perform productivity analysis for equipment.
3. Design equipment fleet for construction task.
4. Perform economic analysis of equipment use.

**Prerequisite:** Possess basic knowledge of construction activities

**Course Content**

Unit No.	Description	Hrs
1.	<b>Earthwork equipment:</b> Fundamentals of earth work task, Earth moving equipment details and operations, Tasks performed by equipment, Equipment fleet combinations.	04
2.	<b>Rock excavation equipment:</b> Methods and practices in rock excavation, Drilling and blasting method, ripping, splitting and mechanical methods of rock excavation and their applications in construction.	04
3.	<b>Equipment productivity analysis:</b> Computing production of earth moving equipment- Dozer, Hoe, Shovel, Loader and Trucks.	04
4.	<b>Equipment fleet design:</b> Concept of fleet, Development of method statement for earthwork tasks, Computation of fleet production and cost, Designing fleet for construction tasks.	04
5.	<b>Construction plants:</b> Ready mix concrete plants, Hot mix asphalt plants, Aggregate production plants. Operations and production planning.	04
6.	<b>Equipment economics:</b>	04







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Equipment records, Cost of capital, Investment alternatives, Elements of ownership and operating cost, Replacement decisions, Rent or lease.	
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**References:**

**Text Books:**

- Peurifoy C., R. L. Ledbetter, W. B. and Schexnayder, "Construction Planning, Equipment and Methods", Tata Mc-Graw Hill, Singapore.
- Sharma S. C., "Construction Equipment and Management", Khanna Publishers, New Delhi.
- Deodhar S. V., "Construction Equipment and Job Planning", Khanna Publishers, New Delhi.
- Sankar S. K. and Saraswati S., "Construction Technology", Oxford University Press, New Delhi.

**Reference Books:**

- James O'Brien, John A. Havers and Frank W. Stubbs, "Standard hand book of Heavy Construction", Mc-Graw-Hill Publication.
- Patrick Powers., J., "Construction Dewatering: New Methods and Applications", John Wiley & Sons.
- Jerry Irvine, "Advanced Construction Techniques", California Rocketry.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. Construction Management	Semester: I	L	T	P	Credits
Course Code : CCM1050	Course Name: Construction Practices	2	-	-	2

**Course Description:**

This course deals with construction practices adopted on heavy construction projects, the course covers most used techniques in majority projects to enable student's ability to complete the construction tasks effectively. Emphasis is on increasing efficiency of the student to control and monitor the tasks on construction projects.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Develop method statement for various construction activities.
2. Differentiate among various practices used to complete construction activities.
3. Choose appropriate technique for particular construction activity.

**Prerequisite:** Basic knowledge of infrastructural engineering and construction techniques.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Pile Construction:</b> Pile, Types, Functions, Construction of bored and driven piles, Construction aspects and details of precast piles, Pre stressed piles, Steel piles and friction piles.	04
2.	<b>Trenchless Technology:</b> Introduction to trench-less technology, Concept, Methods used in trench-less technology, Equipment and applications of trench-less technology.	04
3.	<b>Dewatering:</b> Introduction, Various methods of dewatering, Pumps for dewatering, Design of dewatering system, Cost of dewatering.	04
4.	<b>Offshore Construction:</b> Dredging operation, Methods and Equipment, Construction of Docks and Harbor, Floating docks.	04
5.	<b>Cofferdam and Caisson Construction:</b> Types, Construction of single, double wall cofferdam, Sheet pile cofferdams, Concrete wall movable cofferdam, Cofferdams with touching and interlocking piles and diaphragm wall.	04
6.	<b>High Rise Building Construction:</b> Concept, Methods and techniques used in construction of high rise buildings.	04





**M. Tech. Construction Management Syllabus**  
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**References:**

**Text Books:**

- Peurifoy C., R. L. Ledbetter, W. B. and Schexnayder "Construction Planning, Equipment and Methods", Tata Mc-Graw Hill, Singapore.
- Sharma S. C., "Construction Equipment and Management", Khanna Publishers, New Delhi.
- Sankar S. K. and Saraswati S., "Construction Technology", Oxford University Press, New Delhi.
- Roy Chudley and Roger Greeno, "Construction Technology", Prentice Hall publication.
- Gupta, Y.P., "High rise structures ; design and constructions practices for middle level cities", New Age International Publishers, New Delhi.

**Reference Books:**

- James J.O'Brien, John A. Havers and Frank W. Stubbs, "Standard hand book of Heavy construction", Mc-Graw-Hill Publication.
- Patrick Powers. J., "Construction Dewatering: New Methods and Applications", John Wiley & Sons.
- Jerry Irvine "Advanced Construction Techniques", California Rocketry.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: I	L	T	P	Credits
Course Code : CCM1070	Course Name: <b>Quality Assurance and Quality Control in Construction</b>	3	-	-	3

**Course Description:**

This course provides a systematic development of skills and knowledge required for QA Manager as per the industry requirements including preparation of QCP's, stage wise inspection of QA/QC activities and establishing of Project Quality Plan for construction projects as applicable. This course is designed to fulfill the requirements of quality control by selecting appropriate techniques for different construction activities to assure the construction quality at highest level.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Differentiate between QA and QC in consideration with different construction activities.
2. Apply statistical quality control and monitoring methods.
3. Develop quality checks for construction activities.
4. Develop guideline in accordance with quality standard codes and quality management system.

**Prerequisite:** Possess basic knowledge of construction activities.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Introduction:</b> Introduction to dimensions of quality, Maintaining quality and quality cycle, Quality manual contents and data required, Types of construction defects, Difference between quality assurance and quality control.	05
2.	<b>Statistical Quality Control &amp; Monitoring:</b> Statistical process control, Statistical quality control, Quality measurement attributes and variables, Statistical Process Control (SPC) methods, Control charts for attributes and variables, Acceptance sampling.	05
3.	<b>Construction Quality Control Inspection :</b> Quality management, Duties & responsibilities of QA/QC Managers, Checklists for Quality of Materials and construction processes, QA/QC documentation.	08
4.	<b>Quality References:</b> Quality standards for construction outputs, products and services, Indian	05





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	Standard Code, Use of IS for quality references, National Building Code of India -2016 (NBC) methods of referring it & application.	
5.	<b>Quality Management Systems:</b> Introduction, Benefits of ISO registration, ISO-9000 and ISO14000 certification procedures, ISO requirements, Implementation and its documentation, Quality manuals.	05
6.	<b>TQM for Construction Projects :</b> Total Quality Management (TQM), Determining cost of poor quality including hidden cost, Quality functions deployment (QFD), Importance of third party quality audits, CIDC- CQRA quality rating systems, Customers satisfaction surveys, Non Conformity reports (NCR), Remedial strategy for reducing NCR's.	08

**References:**

**Text Books:**

- A.K. Watal, Mahesh Sharma, "Quality Control in Civil Engineering", Standard Publishers Distributer.
- Manual on Quality Control, Gujarat Engineering Research Institute.
- Rajoria, KB, Narayan, Deepak, Gupta "ISO 9000 Practices In Construction", CBS Publishers & Distributors.
- G.Kanji, "Total Quality Management", Springer Science & Business Media.
- P.L.Jain, "Quality Control and Total Quality Management", Tata Mcgraw Hill Publ.

**Reference Books:**

- Amitva Mitra, "Fundamentals of Quality Control and Improvement", Wiley India Private Limited.
- Jude D'Silva, "Handbook on Quality Assurance & Quality Control in Construction", Publisher: BUUKS.
- Miller, Freund, "Probability and Statistics for Engineers", Hall, Prentice India Ltd.
- Mantri, "Handbook – A to Z of Construction", Mantri Publications
- El Reedy, "Concrete and Steel Construction: Quality Control and Assurance", Taylor and Francis.
- International Standards Organization – ISO 9000 and ISO 14000.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: I	L	T	P	Credits
Course Code : CCM1095	Course Name: <b>Management Information System</b>	3	-	-	3

**Course Description:** This course provides students with an overview of the utilization of business application software and problem-solving using that software. Topics include computer systems, management information systems, microcomputer operating systems, word processing, electronic spreadsheets, database management, business graphics, networks, and integrated packages. Industry accepted microcomputer software will be used.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Demonstrate Information Systems used in organizations for meeting strategic and operational goals.
2. Develop skills using current end-user software for communication, data transformation, collaboration, and problem solving.

**Prerequisite:** Basic knowledge of project life cycle is expected.

Course Content		
Unit No.	Description	Hrs
1.	<b>Introduction:</b> Information systems, Establishing the framework, Business models, Information system architecture, Evolution of information systems.	06
2.	<b>System Development:</b> Modern information system, System development life cycle, Structured methodologies, Designing computer based methods, Procedures, Control - Designing structured programs.	06
3.	<b>Information Systems:</b> Integrated construction management information system, Project management information system, Functional areas, Finance, Marketing, Production, Personnel levels, DSS, EIS, and ES comparison, Concepts and knowledge representation, Managing international information system.	06
4.	<b>Implementation And Control:</b> Control testing security, Coding techniques, Defection of error, Validating cost benefit analysis, Assessing the value and risk of information system.	06
5.	<b>System Audit:</b> Software engineering qualities, Design, Production, Service, Software specification, Software metrics, Software quality assurance.	06
6.	<b>Systems Methodology:</b> Objectives, Time and logic, Knowledge and human dimension, Software life cycle models, Verification and validation.	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- Joyce J Elam, "Case series for Management Information Systems", Custom Publishing.
- Ralph H Sprague and Huge J Watson, "Decision Support for Managers", Prentice Hall.
- Michael W. Evans and John J Marciniak, "Software Quality Assurance and Management", John Wiley and Sons.

**Reference Books:**

- Kenneth C Laudon and Jane Price Laudon, "Management Information Systems - Organization and Technology", Prentice Hall.
- Gordon B. Davis, "Management Information System: Conceptual Foundations, Structure and Development", McGraw Hill.
- Card and Glass, "Measuring Software Design quality", Prentice Hall.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>I</b>	L	T	P	Credits
Course Code : <b>CCM1115</b>	Course Name: <b>Disaster Management</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>

**Course Description:**

The course covers various man-made and natural disasters, risk and risk reduction also takes care of managing processes applied for disaster management. The course also focuses on post disaster problems and mitigation. Student will able to prepare pre and post disaster management plans.

**Course Learning Outcomes:**

After completion of the course, the student will be able to,

1. Summarize effects of natural and man-made disasters.
2. Develop disaster management program.
3. Analyze vulnerable conditions and risk assessment.
4. Prepare plan for post disaster management
5. Describe stakeholder's role in disaster response.

**Prerequisite:** Basic knowledge of Environmental Engineering, Engineering Management

**Course Content**

Unit No.	Description	Hrs
1.	<b>Disasters:</b> Concepts of Hazard, Vulnerability, Risks, Natural Disasters (earthquake, Cyclone, Floods, Volcanoes), and Man Made Disaster ( Armed conflicts and civil strip, Technological disasters, Human Settlement, Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters(Air Crash, tidal waves, Tsunami) Risks, Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief.	06
2.	<b>Approaches to Disaster Risk Reduction:</b> Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural nonstructural measures in DRR, Factors affecting Vulnerabilities, Sustainable Management, Survey of Activities Before Disasters Strike, Survey of Activities During Disasters, DRR Master Planning for the Future.	08
3.	<b>Disaster Management:</b> Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, disaster management framework; financial	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.	
4.	<b>Risk Assessment and Vulnerability Analysis:</b> Disaster preparedness plan, use and application of emerging technologies, role and responsibilities of various agencies and mitigation strategies	04
5.	<b>Disaster Response:</b> Immediate impact and post-impact phase of disasters, Disaster Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Logistics Management, Needs and Damage Assessment, Disaster Response: Central, State, District, and Local Administration, Role of Multiple Stockholders in Disaster Response.	06
6.	<b>Rehabilitation, Reconstruction and Recovery:</b> Damage Assessment, Role of Various Agencies in Disaster Management and Development, Information Management Structure, Parameters of Vulnerability, Development of Physical and Economic Infrastructure, Creation of Long-term Job Opportunities and Livelihood Options, Role of Housing/Building Authorities, Education and Awareness, Long-term Recovery, Long-term Counter Disaster Planning	06

**References:**

**Text Books:**

- Reiter, L., "Earthquake Hazard Analysis: Issues and Insights", Columbia University Press.
- Mileti D.S., "Disasters by Design: A Reassessment of Natural Hazards in United States", National Academic Press.
- Anbalagan R., Singh B., D. Chakraborty and Kohli A., "A field manual for landslide investigations", DST, Government of India, New Delhi.
- Singh R.B. (Ed), "Disaster Management", Rawat Publication, New Delhi.

**Reference Books:**

- Mac Daniels T.L. and Small M.J. (eds.), "Risk Analysis and Society: An Interdisciplinary Characterization of the Field", Cambridge University Press.
- Carter, W.N., Manila, "ADB - Disaster Management": A Disaster Managers Handbook.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. Construction Management	Semester: I	L	T	P	Credits
Course Code : CCM1135	Course Name: Pavement Construction & Management	3	-	-	3

**Course Description:**

This elective, deals with the construction and management of pavements. The course is designed to provide in depth knowledge and skills required to plan, execute and monitor Highway infrastructure projects.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Conduct highway condition assessment surveys.
2. Develop method for pavement management using PMS system.
3. Select material as per MORTH and IRC specifications.
4. Plan and design pavement structures.

**Prerequisite:** Student needs basic knowledge infra structural engineering.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Highway condition surveys:</b> Purpose and Need of Condition Surveys, Serviceability and Roughness, Distresses in Flexible Pavements and Causes, Distresses in Rigid Pavements and Causes, Methods and Equipment for Pavement Condition Surveys.	06
2.	<b>Pavement management system:</b> Key Components of PMS and their activities; Major steps in implementing PMS; Inputs; Design, Construction and Maintenance & rehabilitation policies, HDM III, IV, Paver, PMS implementation & operation issues.	06
3.	<b>Quality Control of pavements:</b> Quality Assurance; Quality Control – ISO 9000, quality assurance plan, quality control check list for road construction, IRC SP 011 specifications	06
4.	<b>Construction of Pavement sub structure:</b> Excavation and Blasting, Embankment Construction, Construction of Gravel Base, Cement Stabilized Sub Bases, WBM Bases, Wet Mix Construction; Crushed Cement Bases, Shoulder Construction, Drainage system.	06
5.	<b>Flexible pavement construction:</b> Bituminous Macadam, Penetration Macadam, Built up Spray Grout, Open Graded Premix, Mix Seal, Semi-Dense Asphalt Concrete-Interface Treatments and Overlay Construction, IRC Specifications, design of flexible pavement.	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

6.	<b>Rigid Pavement Construction:</b> Construction of Cement Roads, Manual and Mechanical Methods, Joints in Concrete and Reinforced Concrete Pavement and Overlay Construction, design of rigid pavement, over lay design.	06
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**References:**

**Text Books:**

- S K Khanna, "Highway Engineering", Publisher-Nem Chand & Bros.
- T.D Ahuja, "Highway Engineering", Rajsons Publications Pvt. Lt. Daryaganj, Delhi.
- IRC 37: Design of flexible Pavement.
- IRC 58: Design of rigid pavement.

**Reference Books:**

- Ghazi G. Al-Khateeb, "Highway Planning, Survey, and Design", CRC Press.
- Byrne Austin, "Highway Construction", T Publisher Forgotten Books.
- T.W. Faw , "Handbook of Highway Engineering", publisher Taylor & Francis NY.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>I</b>
Course Code : <b>CCM1150</b>	Course Name: <b>Repair and Rehabilitation of Structures</b>

L	T	P	Credits
<b>3</b>	-	-	<b>3</b>

**Course Description:**

An elective course which is very much needed for all civil engineers, every structure built needs maintenance and repairs. This course will help students to learn how building or structures can be repaired or rehabilitated.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Perform Assessment of buildings.
2. Recognize damages in the structure.
3. Select proper repair materials.
4. Suggest repair or rehabilitation method for particular damage.

**Prerequisite:** Possess basic knowledge of construction activities.

**Course Content**

Unit No.	Description	Hrs
<b>1.</b>	<b>Introduction:</b> Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures. Maintenance importance of maintenance, routine and preventive maintenance.	<b>06</b>
<b>2.</b>	<b>Damages to Buildings:</b> Various damages to masonry structures and causes, Various cracks in R.C. buildings, causes and effects.	<b>06</b>
<b>3.</b>	<b>Repair materials:</b> Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, Special mortars and concretes, Grouting materials, Bonding agents, Protective coatings and FRP sheets.	<b>06</b>
<b>4.</b>	<b>Damage diagnosis and assessment:</b> Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing (Case Study).	<b>06</b>
<b>5.</b>	<b>Corrosion and Repairs:</b> Corrosion of embedded steel in concrete, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns) Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing.	<b>06</b>







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

6.	<b>Rehabilitation:</b> Jacketing and Strengthening: Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing. Strengthening, Beam shear strengthening, Flexural strengthens.	06
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**References:**

**Text Books:**

- S.Champion , “Failures and repair of concrete structures”, John Wiley and Sons.
- R.N.Raikar, “Diagnosis and treatment of structures in distress”,Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai.
- “Handbook on repair and rehabilitation of RCC buildings”, CPWD, Government of India.
- A. Chakrabarti ,“Handbook on seismic retrofit of buildings”, Narosa Publishing House.

**Reference Books:**

- Noel P.Mailvaganam , “Repair and protection of concrete structures”, CRC Press.
- Peter.H.Emmons, Galgotia, “Concrete repair and maintenance”, Galgotia publications Pvt. Ltd.
- Pankaj Agarwal, Manish Shrikande, “Earthquake resistant design of structures”, PHI.Pvt. Ltd.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester : I
Course Code : <b>CCM1175</b>	Course Name: <b>Bridge Construction</b>

L	T	P	Credits
3	-	-	3

**Course Description:**

This course "Bridge Construction" covers various aspects of Bridge construction along with bringing out the advanced theories and practical knowledge of Bridge construction. Each topic is developed in logical progression with up-to-date information with reference to codal provisions and journals.

**Course Learning Outcomes:**

- After successful completion of the course, students will be able to,
1. Select location for bridge based on topographical and geotechnical investigation.
  2. Perform hydrological calculations of design parameters.
  3. Apply standard loadings and safety consideration for bridge design.
  4. Select appropriate bridge superstructure elements for bridges.

**Prerequisite:** Student should have knowledge about bridge components and types.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Introduction:</b> History of Bridges; Components of a Bridge and its definitions, Classification of Road Bridges, related structures, span length, Classical Examples. Historical developments, Case studies.	04
2.	<b>Investigation for Bridges:</b> Need for investigation, selection of bridge site, Collection of Bridge design data; Hydrological calculation. Waterway calculation; Scour calculation; Depth of foundation; Freeboard, Collection of Bridge design data; Vertical clearance. Economic span, Location of piers & Abutments, Traffic projections, Investigation reports, Importance of proper investigation.	06
3.	<b>Loading Standards for Bridge Design:</b> Road Bridges: IRC, BS code, AASHTO code. Dead load, Live load, Impact factor, Centrifugal force, Wind loads, hydraulic forces, Longitudinal forces, Seismic forces; Earth pressure. Buoyancy; Lane concept, equivalent loads, traffic load; Width of Roadway and Footway. Influence lines for statically; determinate structures. I.L. for statically indeterminate structures. Transverse distribution of Live loads among deck longitudinal, Load combinations for different working state and limit state designs. Railway Bridges: Loadings for Railway Bridges; Railroad data, Pre-design considerations; Railroad vs. Highway bridges	08
4.	<b>Superstructures:</b> Selection of main bridge parameters, design methodologies, Choices of superstructure types, Slab bridge and voided slab	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	bridge; Beam-Slab bridge; Box Girder Bridge, Typical Details, Slab Bridge. Slab-Girder Bridge (Straight/Skew), Box Girder Bridge (Straight/ Skew).	
5.	<b>Bridge Components:</b> Pier; Abutment; Wing walls; Importance of Soil-Structure Interaction; Types of foundations, Open foundation; Pile foundation; Well foundation; Examples - Simply supported bridge, Continuous Bridge.	06
6.	<b>Bearings and Deck Joints:</b> Different types of bridge bearings and expansion joints; Design of bearings and joints, Parapets and Railings for Highway Bridges; Definitions; Classification of Highway Bridge parapets; Various Details.	06

**References:**

**Text Books:**

- Raina V. K. "Concrete Bridge Practice, Analysis, Design and Economics", Tata McGraw- Hills Publishing Company Limited.
- Rajagopalan R. "Bridge Superstructure", Tata McGraw- Hills Publishing Company Limited.
- Ponnuswamy S., "Bridge Engineering", Tata McGraw - Hills Publishing Company Limited.
- Aswani M. G., V. N. Vazirani and M.M. Ratwani, "Design of Concrete Bridges", Khanna Publishers.

**Reference Books:**

- E.C.Hambly , "Bridge Deck Behaviour", E & FN SPON Publications New York.
- M J Ryall; G A R Parke; J E Harding, "The manual of bridge engineering", Institution of Civil Engineers (Great Britain), London.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>I</b>	L	T	P	Credits
Course Code : <b>CCM1195</b>	Course Name: <b>Prefabricated Structures</b>	<b>3</b>	-	-	<b>3</b>

**Course Description:**

This course offered as elective, deals with the fast and pre design construction methods and detailing. Pre designed buildings and other infrastructure structural components are being used by the industry a lot today, so, this course will provide students insight about prefabricated buildings.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Choose prefabricated elements for construction.
2. Develop detail drawings of prefabricated elements.
3. Design prefabricated elements for construction.
4. Prepare project report for establishing production unit.

**Prerequisite:** Students should know the elements of building.

Course Content		
Unit No.	Description	Hrs
1.	<b>Introduction:</b> Introduction to Prefabricated Structures, Application of prefabricated structures, Comparison of conventional structures and prefabricated structures.	06
2.	<b>Types of fabrication:</b> Modular co-ordination, Components, Prefabrication systems and structural schemes; Design considerations; Economy of prefabrication; Prefabrication of load carrying members.	06
3.	<b>Pre stressing Application:</b> Application of pre-stressing of roof members; Floor systems; Two way load bearing slabs, Wall panels, Hipped plate and shell structures.	06
4.	<b>Design of Prefabricated Structures:</b> Disuniting of structures; Design of cross section of load carrying members; Structural behavior of precast structures. Handling and erection stresses.	06
5.	<b>Detailing:</b> Dimensioning and detailing of joints for different structural connections; Construction and expansion joints.	06
6.	<b>Production, Transportation &amp; erection:</b> Organization of production, storing and erection equipment; Shuttering and mould design – Dimensional tolerances; Erection of R.C. structures, Total prefabricated buildings.	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- IS 15917, (2010) "Building Design & Erection Using Prefabricated Concrete".
- "Architectural Precast Concrete", by Pre stressed Concrete Institute.

**Reference Books:**

- Bruggeling A. S. G and G.F Huyghe, "Prefabrication with Concrete", CRC Press,
- Gilbert R. L and N.C Mickeborough, "Design of Prestressed Concrete", Taylor & Francis





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>I</b>	L	T	P	Credits
Course Code : <b>CCM1210</b>	Course Name: <b>Advanced Concrete Technology</b>	3	-	-	3

**Course Description:**

This course is intended to support the students to design high performance concrete mixes by means by correct material selection, mix design, and construction practices mixture. Course contents also involves studies of topics regarding fresh and hardened concrete behavior also with long term performance concerns, associated with creep, shrinkage and durability aspects of concrete.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Select binders, SCMs and admixtures to design strong, durable and sustainable concretes.
2. Analyze the factors affecting properties of fresh concrete.
3. Develop quality control plan for a concrete construction.
4. Design special purpose concrete mixes using mix design procedures recommended by pertinent codes of practices and handbooks.

**Prerequisite:** Possess basic knowledge of concrete technology.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Binders:</b> Working Mechanisms and types, Covering pulverized fuel ash, Ground granulated blast furnace slag and silica fume; Chemical composition; Physical characteristics; Chemical and physical interaction with processes of hydration; Effects on properties of concretes, Mortars and grouts; Methods of testing; Applications; Blended cements. Introduction to ternary cement mixes.	06
2.	<b>Admixtures:</b> Working Mechanisms and classification; Chemical composition; Origin and manufacture; Actions and interactions; Application; Effects on properties of concretes, Mortars and grouts; Methods of testing; Applications.	06
3.	<b>Fresh concrete:</b> Different models of elastic behavior of concrete, Concrete rheological models of concentrated suspensions, Pastes, Mortars and concretes; Viscoelasticity in	04







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	concrete.	
4.	<b>Volume Changes in Concrete:</b> Early Age Cracking and its mechanism in Concrete, Plastic settlement and plastic shrinkage, Methods for predicting creep and shrinkage.	04
5.	<b>Onsite Quality Control:</b> Quality assessment and control measures during the concreting process, Quality control charts, Placing and pumping of concrete, Compaction of concrete Advances in curing, Curing chemicals.	08
6.	<b>Mix design:</b> Review of methods and philosophies; Mix design of special purpose concretes, Hands on concrete casting and testing.	08

**References:**

**Codes of Practice:**

- Bureau of Indian Standards IS: 10262-2019. Indian standard code of practice for recommended Guidelines of Concrete Mix Design plain and reinforced concrete. New Delhi, BIS.
- Bureau of Indian Standards IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.
- Bureau of Indian Standards IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete. New Delhi, BIS.
- ACI 211.1-91.
- Handbook on Concrete Mixes SP 23: 1982, 2001.

**Text Books:**

- Santhakumar, A.R., "Concrete Technology", Oxford University Press, New Delhi.
- Gambhir, M.L., "Concrete Technology", Tata Mc Graw-Hill Publishing Company Limited, New Delhi.

**Reference Books:**

- Mehta, P. K. and Monteiro, P.J. M., "Concrete Microstructure, Properties and Materials", Mc Graw Hill Publications, NY.
- Shetty, M.S., "Concrete Technology", S. Chand & Company Ltd., New Delhi.
- Kett Irving, "Engineered Concrete Mix Design and Test Methods", CRC Press Taylor & Francis Group, Florida, USA.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: I
Course Code : CCM1235	Course Name: <b>Construction Waste Management</b>

L	T	P	Credits
3	-	-	3

**Course Description:**

Waste management is the need of the hour, construction waste generated is in huge amount and needs to be planned for its reuse, recycle before sending for land filling. This course is designed to cover government policies and other techniques of waste minimization.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Develop strategies for construction and demolition waste management and resource efficiency.
2. Examine the environmental impact of building materials.
3. Design site waste management plans.
4. Justify the application of waste minimization techniques on construction site.

**Prerequisite:** Basic knowledge of Environmental Engineering

Course Content		
Unit No.	Description	Hrs
1.	<b>Environmental impact:</b> Environmental Impact of Building Materials Embodied energy of materials; impact on the local environment; toxicity of the material.	06
2.	<b>Waste Assessment:</b> Life cycle assessment. Nature and Source, Direct and indirect waste; site types and origins; composition; quantity; current recycling/reuse potential of building materials.	06
3.	<b>Construction and Demolition Waste:</b> Construction and Demolition Waste Management Plans International good practice; planning requirements; demolition plans; Site implementation; supplier agreements; sub-contractor management.	06
4.	<b>Roles and Responsibility:</b> Role of waste management contractor; training; auditing; skip management; current markets; current disposal options; health and safety; reporting to local authorities. Treatment of Construction and Demolition Waste, waste permits; waste licenses; waste transfer facilities; landfills; treatment technologies; hazardous waste facilities; reporting to EPA.	06
5.	<b>Waste minimization:</b> Designing for Waste Prevention and Minimization Waste prevention and minimization; client, contractor and designer attitudes; proper maintenance of existing buildings; reuse of existing building structure; design flexibility; design for reuse and recycling;	06







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**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	dimensional Co-ordination and standardization; modular design; material selection and control.	
6.	<b>Waste forecasting:</b> Waste Forecasting Tools Application of WRAP's designing out waste tool for buildings and civil engineering; WRAP net waste tool; BRE SMART Waste; WRAP Site Waste Management Plan Tracker.	06

**References:**

**Text Books:**

- Greg Winkler, "Recycling Construction and Demolition waste: A LEED-Based Toolkit (Green Source) (Google ebook), Mc Graw Hill Professional.
- V M Tam, Chi Ming Tam, "Reuse of Construction and Demolition Waste in Housing Development", Nova Science Publishers.

**Reference Books:**

- Richard Ian Stessel "Recycling and Resource Recovery Engineering", Springer-Verlag Berlin Heidelberg.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>I</b>	L	T	P	Credits
Course Code : <b>CCM1255</b>	Course Name: <b>Microsoft Project (MSP) Laboratory</b>	-	-	4	2

**Course Description:**

Computer based project management is vital in construction industry. Microsoft project software is used for analyses complex projects. Microsoft project software offers planning, scheduling and controlling of civil engineering projects. Course is designed to make graduates familiar with the current planning software used in industry; in this course students will acquire knowledge and expertise/hands-on in Micro soft project software.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Develop Work Breakdown Structure for project.
2. Prepare project schedule using Microsoft project.
3. Modify construction schedule based on site progress.
4. Extract and present various types of reports.

**Prerequisite:** Engineering / Construction Management

<b>Course Content</b>		
<b>Experiment No.</b>	<b>Description</b>	<b>Hrs</b>
1.	Acquiring expertise in Microsoft Project.	16
2.	Solve 4 assignments on Construction planning and control.	16
3.	Plan two projects using Microsoft Project.	16







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: I
Course Code : <b>CCM1275</b>	Course Name : <b>Geographic Information System Laboratory</b>

L	T	P	Credits
-	-	4	2

**Course Description:**

This laboratory course is designed to make graduates familiar with advanced surveying equipment and Geographic information system software and its application in civil engineering.

**Course Learning Outcomes:**

- After successful completion of the course, students will be able to,
1. Perform data collection using tools.
  2. Analyze data using GIS software.
  3. Prepare and present maps in GIS.

**Prerequisite:** Basics of Engineering Geology/Geography.

**Course Content**

Experiment No.	Description	Hrs
1.	Learning use of instrument/software.	16
2.	Application of instrument/software to complete a given task.	12
3.	Apply knowledge of software to a given project.	20





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: I
Course Code : SHP5511	Course Name : <b>Technical Communication</b>

L	T	P	Credits
2	-	-	<b>Audit Course</b>

**Course Description:**

This course is designed to help students in improving skills that will enable them to produce well designed technical documents and to deliver impressive oral presentations. The course focuses on principles of effective writing and on types of documents common in technical fields. While the emphasis will be on writing, oral communication of technical information will form an important component of the course, as well. The course assists students in preparing them for oral presentations in various professional contexts.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Acquire skills required for good oral and written communication.
2. Demonstrate improved writing skills and level of readability.
3. Ensure the good quality of technical reports at very first-time submission.

**Prerequisite:**

Students who enrol themselves to this course should have adequate LSRW abilities of English language.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Planning:</b> Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	04
2.	<b>Process:</b> Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism.	03
3.	<b>Content Writing:</b> Sections of a Paper, Abstracts, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions and The Final Check.	03
4.	<b>Key Skills:</b> Key skills needed when writing a Title, key skills needed when writing an Abstract, key skills needed when writing an Introduction, skills needed when writing a Review of the Literature.	04
5.	<b>Skill Set:</b> Skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills needed when writing the Conclusions, useful phrases, how to ensure good quality of the paper at the time of submission.	04







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

6.	<b>Professional skills:</b> Resume Writing, e-Mails, Interview skills, Dos and Don'ts while Answering, FAQs, GROUP DISCUSSION: Structured and Unstructured GD, Opening and Closure, Showing Agreement and Disagreement.	06
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**References :**

**Text Books:**

- John Seely, "Oxford Guide to Effective Writing and Speaking", Oxford University Press.
- Jeff Butterfield, "Soft Skills for Everyone", Cengage Learning India Private Limited
- Goldbort R, "Writing for Science", Yale University Press.
- Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press

**Reference Books:**

- Adrian Wallwork, "English for Writing Research Papers", Springer, Dordrecht Heidelberg London.
- Thomas N. Huckin and Leslie A. Olsen, "Technical Writing and Professional Communication for Nonnative Speakers of English", Tata McGraw Hills.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: II	L	T	P	Credits
Course Code : <b>CCM1020</b>	Course Name: <b>Project Economics &amp; Financial Management</b>	<b>2</b>	-	-	<b>2</b>

**Course Description:**

Aim of including this subject is to make graduates familiar with Project Economics and its comparison in civil engineering. This course will help graduates to understand, manage and control the project finance in appropriate manner. Divided into six units this takes care of major roles played by project managers.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Analyze projects using different techniques.
2. Suggest different sources of finance.
3. Analyze different financial statement with the help of ratio analysis.

**Prerequisite:** Student should possess Basics of Mathematics, Basics of Economics

**Course Content**

Unit No.	Description	Hrs
1.	<b>Foundation of Engineering Economy:</b> Concept of Engineering economy, Interest rate- Simple and compound, Cash flow, Factors-Single payment Factors, Uniform series factors, gradient factors, Nominal and effective interest rate.	04
2.	<b>Evaluation of Engineering Project:</b> Present worth analysis, capitalized cost analysis	04
3.	<b>Evaluation of Engineering Project:</b> Annual worth analysis, Rate of return analysis.	04
4.	<b>Evaluation of Engineering Project:</b> Benefit cost analysis, Breakeven, Sensitivity and payback analysis.	04
5.	<b>Capital Structure:</b> Sources of finance (long term and short term sources) available for construction projects, Sources of long term finance - Securities (Ordinary shares, Preference shares, Debentures or bonds), Loan capital. Short term Sources of finance- Trade Credit, Accruals, Commercial Paper, Bank credit, Public Deposit, Inter-Corporate Deposits, Private Institutions	04
6.	<b>Financial Statement Analysis:</b> Ratio Analysis- computation of liquidity ratios, leverage ratios, activity ratios & profitability ratios.	04







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- Mithani D. M., "Managerial Economics", Himalaya publication.
- Chandra Prasanna, "Financial Management", Tata McGrawHill, NewDelhi.
- Jain Khanand, "Financial Management", Tata McGrawHill, NewDelhi.
- Pande I. M., "Financial Management", Vikas House Publication.

**Reference Books:**

- Leland Blank and Anthony Tarquin, "Basics of Engineering Economy", Tata McGrawHill, NewDelhi.
- Chandra Prasanna, "Projects Planning, Analysis Selection, Implementation and Review", Tata McGrawHill, NewDelhi.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>II</b>	L	T	P	Credits
Course Code : <b>CCM1040</b>	Course Name: <b>Legal Aspects in Construction</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>

**Course Description:**

This course will cover the entire process of construction contracts, starting from tender notice to arbitration.

**Course Learning Outcomes:**

- After successful completion of the course, students will be able to,
1. Select appropriate type of contract for construction projects.
  2. Develop tender document for construction project.
  3. Perform comparative analysis of types of contract.
  4. Analyze arbitration documents for construction project.

**Prerequisite:** Should know the basics of Estimating Costing

Course Content		
Unit No.	Description	Hrs
1.	<b>Introduction:</b> Essential of valid contract, Types of Contract, Void, Voidable & Valid contract, Offer, Proposal, All in contract, Lump sum contract, Cost plus contract, Item rate contract, Labour contract, BOT, BOOT, DBT contract.	04
2.	<b>Tender:</b> Tender documents, Invitation of tenders, re-qualification of contractor, Tender Notice, Preparation of tender, Submission of Tender, Opening Tender, Acceptance/ Rejection of tender.	04
3.	<b>Contract Documents:</b> Role of an Engineer, Contractor & Owner, Conditions of contract, Performance security, Security deposit, General conditions of contract, Specific conditions of contract, Suspension of work, Time limit for completion, Liquidated damage, Measurement & Payment, Additions, Alterations or variation & deviations, Defects, Maintenance & Improper work, Subletting, Breach of contract, Settlement of account of final payment, Claims.	04
4.	<b>Payment and bills:</b> Measurement & Payment, Additions, Alterations or variation & deviations, Defects, Maintenance & Improper work, Subletting, Breach of contract, Settlement of account of final payment, Claims	04
5.	<b>Contract of Indemnity &amp; Guarantee:</b> Indemnity and Guarantee- Difference between the two contracts, consideration for guarantee, surety' s liability, discharge of surety. Bailment- Nature of transactions,	04







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	delivery of bailee, Bailee' s responsibility, Termination, Bailment of pledges.	
6.	<b>Arbitration:</b> Meaning of arbitration, Advantages of arbitration, Types of arbitration, Distinction between arbitration & expert determination, Arbitrator, Valuer, Engineer, Architect, Referee, Conciliator, Mediator, Arbitral award, arbitral tribunal.	04

**References:**

**Text Books:**

- Patil B. S., "Contracts & Estimates", CRC Press.
- B. P. Saraf , "Law of Arbitration and Conciliation", Snow white publications.

**Reference Books:**

- Namarari Roshan H., "Professional practice with Elements of Estimating Valuation Contract and the arbitration Act", Lakhani Book Depot.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>II</b>
Course Code : <b>CCM1060</b>	Course Name: <b>Project Formulation and Appraisal</b>

L	T	P	Credits
2	-	-	2

**Course Description:**

This course has been introduced as an elective course to train students in identification, evaluation, structuring and appraisal of various construction, building, infrastructure and engineering projects.

**Course Learning Outcomes:**

- After successful completion of the course, students will be able to,
1. Perform technical and financial analysis of construction projects.
  2. Perform BC ratio analysis.
  3. Select project based on appraisal.
  4. Develop administration process for project execution.

**Prerequisite:** Should have basic knowledge of project phases

**Course Content**

Unit No.	Description	Hrs
1.	<b>Introduction:</b> Identification of needs, present availability, additional requirements, alternatives and their comparative study, project identification.	04
2.	<b>Technical Feasibility:</b> Technical analysis market and demand analysis, project location resource requirement and their fulfillment technology, know how requirements technical study of alternatives and their suitability.	04
3.	<b>Financial Feasibility:</b> Investment and capital outlay cash flow of the project and its significance profit, Probability and break even analysis, internal rate of return, of shadow pricing benefit cost ratio	04
4.	<b>Cost-Benefit Analysis:</b> Social cost benefit analysis, objectives, direct – indirect costs and benefits – tangibles, intangibles and their conversion, levy subsidy concepts	04
5.	<b>Appraisal:</b> Criteria and selection from alternatives, discounting non discounting criteria selection under capital restriction, social restriction and other restriction risk analysis	04
6.	<b>Administration:</b> Project administration organization and control during execution period maintenance and care taker operational set up, project management after completion. Preparation of project report and norms and its presentation.	04







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**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- Prasanna Chandra, "Project Preparation, Appraisal, Budgeting and implementation"
- E. J. Mishan, "Cost Benefit Analysis"
- Chandra P. "Projects, planning, analysis, financing, implementation and review", Tata Mc-Graw-hill New Delhi

**Reference Books:**

- Tiffin R., "Practical techniques of effective project investment appraisal", Viva Books, New Delhi
- Khatua S., "Project Management and Appraisal", Oxford University Press, New Delhi





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech. Construction Management</b>	Semester: <b>II</b>
Course Code : <b>CCM1080</b>	Course Name: <b>Advanced Construction Techniques</b>

L	T	P	Credits
3	-	-	3

**Course Description:**

To study and understand the latest construction techniques applied to engineering Construction of infrastructures like high rise structures, metros, bridges etc.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Use modern construction techniques in the high rise structures.
2. Identify the suitable formwork technique used to construct a structure.
3. Justify the concepts used in the construction of special structures.

**Prerequisite:** Student needs basic knowledge construction techniques.

**Course Content**

Unit No.	Description	Hrs
1.	<b>High rise buildings:</b> Construction methods and techniques using in-situ concrete, Precast Concrete & Structural Steel, finished concrete, tunnel form, fire Fighting ,Safety	6
2.	<b>Innovative methods of construction:</b> Slip form technology, Jump-form technology, Dry wall technology, Plastering Machines.	6
3.	<b>Construction of Metro Railway:</b> Underground and over ground structures, different methods and techniques of construction.	6
4.	<b>Bridges:</b> Introduction, Construction of special type of bridges such as cable stayed bridge, suspension and Pre-stressed bridge, construction of foundation and Super structure	6
5.	<b>Off shore structure Construction:</b> Beacons, Oil drilling Platforms. Dredging equipment and techniques for construction of Channels and Islands.	6
6.	<b>Piling:</b> Single pile and a group piles (Bored and Driven) during Construction Methods of pile driving by Vibration and Construction of micro piles, Diaphragm Walls, Details of precast piles, pre stressed piles, steel piles and friction piles.	6







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- Bryan, "Construction Technology: Analysis, and Choice", 2ed. Wiley India.
- Rajiv Gupta, "Construction Planning and Technology", 2 ed, CBS publisher, New Delhi.
- Sanjay Gupta, "Construction technology & Management", Vayu Education of India.
- S.P Bindra, "Principles and Practices of Bridge Engineering", Dhanpat Rai Publication.

**Reference Books:**

- Roy Chudley and Roger Greeno, "Construction Technology", Prentice Hall.
- Peurifoy, "Construction Planning, Equipment and methods", Tata McGraw Hill Publication.
- Journals such as CE & CR. Construction world, International Construction.
- Brochures Published by various agencies associated with construction.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>II</b>	L	T	P	Credits
Course Code : <b>CCM1105</b>	Course Name: <b>Health and Safety Management</b>	<b>3</b>	-	-	<b>3</b>

**Course Description:**

Major accidents in industries across the world during the last two or three decades have led to generation of enormous interest in Occupational Safety and Health, as well as in the environment. On any project there is always the possibility of an accident or damage to someone's health. The work exposes people to hazards, be they: loads which have to be manually handled; dangerous machinery; toxic substances; electricity; working with display screen equipment or even psychological hazards such as stress. The course addresses the codal provisions and regulations to be followed on site.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Classify hazards to employees on construction site.
2. Determine safe practices necessary for a project site.
3. Identify the causes of accidents and suggest preventive measures to avoid accident.
4. Prepare safety management plan.

**Prerequisite:** Basic knowledge of Safety Engineering

**Course Content**

Unit No	Description	Hrs
1.	<b>Introduction:</b> Hazards and causes of accidents, safety measures	06
2.	<b>Safety Laws:</b> Safety legislation and standards for construction industry	06
3.	<b>Safety in Construction I:</b> Safety precautions and practices in various construction activities like excavation, concreting	06
4.	<b>Safety in Construction II:</b> scaffold erection and dismantle, concreting, steel erection and demolition of structures	06
5.	<b>Accident Management:</b> Management of accidents Organization for safety	06
6.	<b>Construction Site Safety:</b> Occupational hazards and personal protective equipment, site management, safety manual and check lists safety officer, safety committee, safety training, safety audit	06







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**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- NSC, Accident Prevention Manual for Industrial Operations.
- Fulman, J.B., "Construction Safety, Security, and Loss Prevention", John Wiley and Sons.
- ILO, Safety and Health in Construction.

**Reference Books:**

- Hudson R and R W King, "Construction hazard & Safety handbook", Butterworths.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: II	L	T	P	Credits
Course Code : CCM1125	Course Name: <b>Human Resource Management</b>	3	-	-	3

**Course Description:**

This course satisfies the requirement of managing human resource in an enterprise, this course covers manpower planning, organization and human well fare. Also covers human behavior and its impact and development of personnel for the organization.

**Course Learning Outcomes:**

- After successful completion of the course, students will be able to,
1. Plan manpower for a project.
  2. Develop organization for a project.
  3. Apply aspects of human behavior to HRM.
  4. Select right person to build the team.
  5. Discuss solutions for human resource problems.

**Prerequisite:** Know the personnel operating construction projects

Course Content		
Unit No.	Description	Hrs
1.	<b>Manpower Planning:</b> Manpower Planning, Organizing, Staffing, directing, and controlling – Personnel Principles.	06
2.	<b>Organization:</b> Organization – Span of Control – Organization Charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection - Placement, Training and Development.	06
3.	<b>Human Behavior:</b> Introduction to the field of people management - basic individual psychology; motivation - Job design and performance management - Managing groups at work - self-managing work teams - inter group behavior and conflict in organizations – Leadership - Behavioral aspects of decision-making; and communication for people management.	06
4.	<b>Welfare Measures:</b> Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.	06
5.	<b>Management and Development Methods:</b> Compensation - Wages and Salary, Employee Benefits, employee appraisal and assessment - Employee services - Safety and Health – Discipline and discharge.	06
6.	<b>Special Problems:</b> Special Human resource problems, Performance	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	appraisal. - Employee hand book and personnel manual - Job descriptions and organization structure and human relations – Productivity of Human resources.	
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**References:**

**Text Books:**

- Josy.J. Familiaro, "Handbook of Human Resources Administration", McGraw-Hill International Edition.
- Charles D Pringle, "Justin Gooderi Longenecter, Management", CE Merril Publishing Company
- Dwivedi R.S, Macmillian, "Human Relations and Organisational Behaviour", India Ltd.

**Reference Books:**

- Carleton Counter II and Jill Justice Coutler, "The Complete Standard Handbook of Construction Personnel Management", Prentice-Hall, Inc., New Jersey.
- Memoria, C.B., "Personnel Management", Himalaya Publishing Company.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>II</b>	L	T	P	Credits
Course Code : <b>CCM1145</b>	Course Name : <b>Shoring, Scaffolding and Formwork</b>	3	-	-	3

**Course Description:**

Temporary works are very important as they provide shape and stability to concrete in its green state. The form work and scaffold needs to be so designed that it does not vary in its shape or performance. It is Important to study this course as a civil engineer.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Develop proper plan for form-work.
2. Select appropriate material and type of form-work.
3. Design form-work for components.
4. Design scaffold for construction task.

**Prerequisite:** Basic knowledge of scaffoldings

<b>Course Content</b>		
Unit No.	Description	Hrs
1.	<b>Planning, site equipment and plant for form work:</b> Overall Planning – Detailed Planning – Standard units – Corner units – Schedule for column form-work – Form-work elements – Planning at Tender stage – Development of basic system – Planning for maximum reuse – Economical form construction – Planning examples – Crane size, effective scheduling estimate – Recheck plan details – Detailing the forms. Crane arrangement – Site layout plan – Transporting plant – Form-work beams – Form-work ties – Wales – Scaffold frames - Form accessories – Vertical transport table form work.	06
2.	<b>Form materials and pressures on form-work:</b> Lumber – Types – Finish – Sheathing boards - Working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminum Form lining materials – Hardware and fasteners – Nails in Plywood – Bolts lag screw and connectors – Bolt loads. Pressures on Form-work - Concrete density – Height of discharge – Temperature – Rates of Placing – Consistency of concrete – Live loads and wind pressure – Vibration Hydrostatic Adjustment for non-standard condition.	06
3.	<b>Shores and form design:</b> Simple wood stresses – Slenderness ratio – Allowable loads – Tubular steel shores - Patented shores – Site Preparation - Size and spacing – Steel Tower Frames – Safety practices – Horizontal shoring for multi-levels – More concentrated shore loads - T-heads – Two tier wood shores – Ellis shores – Dayton sure grip and Baker Roos shores – Safway Symons shores – Beaver Advance shores - Dead shores – Raking	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	and Flying shores Basic simplification – Beam formulas – Allowable stresses – Deflection bending lateral stability – Shear, Bearing – Examples in wall forms – Slab forms – Beam form – Ties, Anchors and Hangers – Column forms – Examples in each.	
4.	<b>Dome forms, tunnel forms and safety practices for scaffolds:</b> Shells of translation and revolution - Hemispherical – Parabolic - Barrel vaults – Hypar Shells – Conoidal Shells - Folded plates – Shell form design – Building the form – Placing concrete – Strength requirements – Tunnel forming components – Curb and Invert forms – Arch and Wall forms - Telescopic forms – Concrete placement methods – Cut and Cover construction – Continuous Advancing slope method - Bulk head method – General design considerations influence of placing equipment – Tolerances – Form construction for Shafts.	06
5.	<b>Slipforms:</b> – Principles – Types – Advantage – Functions of various components – Planning of Slipform operations – Desirable characteristics of concrete – Common problems faced – Safety in slip forms -	06
6.	<b>Special structures built with Slipform Technique:</b> – Code provisions – Types of scaffolds – Putlog and Independent scaffold – Single pole scaffolds – Fixing ties – Spacing of ties - Plan Bracing – Knots – Safety nets – General safety requirements – Precautions against particular hazards – Truss, Suspended – Gantry and system scaffolds.	06

**References:**

**Text Books:**

- Austin, C.K., “Formwork for Concrete”, Cleaver – Hume Press Ltd., London.
- Tudor Dinescu and Constantin Radulescu, “Slip form Techniques”, Abacus Press, Turn Bridge Wells, Kent.

**Reference Books:**

- Hurd, M.K., “Formwork for Concrete”, Special Publication No. 4.
- Michael P. Hurst, “Formwork”, Construction Press, London and New York.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. Construction Management	Semester: II	L	T	P	Credits
Course Code :SHP5261	Course Name: Probability and Statistics for Engineers	3	-	-	3

**Course Description:** The course introduces students to the formulation, methodology and techniques for Probability and Statistics to solution of engineering problems. The course intends to build the competency in the students to apply the knowledge of Probability and Statistics to the solution of engineering problems and to analyze it. The course covers the topics: Discrete Probability Distributions, Continuous Probability Distributions, Fundamental Sampling Distributions, One- and Two-Sample Estimation Problems, Simple Linear Regression and Correlation.

**Course Learning Outcomes:**  
After successful completion of the course, students will be able to,

1. Apply relevant probability distribution for given problems.
2. Use different methods of sampling and testing in statistical inference.
3. Solve problems on correlation and regression.

**Prerequisite:** Calculus, Matrix Algebra

Course Content		
Unit No.	Description	Hrs
1.	<b>Discrete Probability Distributions</b> Introduction and motivation, Discrete uniform distribution, Binomial and multinomial Distributions, Hypergeometric Distribution, Negative Binomial and Geometric Distributions, Poisson distribution and the Poisson Process, Multinomial Distribution.	06
2.	<b>Continuous Probability Distributions</b> Continuous uniform distribution, Normal Distribution, Areas under the Normal curve, Applications of the Normal Distribution, Normal Approximation to the Binomial Distribution, The Gamma and Exponential Distributions, Applications of the Exponential Distributions and Exponential Distributions.	06
3.	<b>Fundamental Sampling Distributions</b> Random Sampling, Some important Statistics, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, Sampling Distribution of $S^2$ , t-Distribution, F-Distribution.	06
4.	<b>One- and Two-Sample Estimation Problems</b> Statistical Inference, Classical Methods of Estimation, Single Sample:	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Two Samples: Estimating the Difference between Two Means, Single Sample: Estimating a Proportion, Single Sample: Estimating the Variance, Two Samples: Estimating the Ratio of Two Variances.	
5.	<b>One- and Two-Sample Tests of Hypotheses</b> Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, One- and Two- Tests, The use of P-Values for Decision Making in Testing Hypotheses, Single Sample: Tests Concerning a Single Mean (Variance known), Relationship to confidence Interval-Estimation, Two Samples: Tests on Two Means, Choice of Sample Size for Testing Means, One Sample: Test on a Single Proportion, Two Samples: Tests on Two Proportions, One- and Two- Tests concerning Variances, Goodness-of-Fit Test.	06
6.	<b>Simple Linear Regression and Correlation</b> Introduction to Linear Regression, The Simple Linear Regression Model, The fitted Regression Line, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inference concerning the Regression Coefficients, A measure of quality of Fit: Coefficient of Determination, Prediction.	06

**References:**

**Text Books:**

- Miller, "Probability and Statistics for Engineers", Freund-Hall, Prentice India Ltd.
- Ronald E. Walpole, Sharon L. Mayers and Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson.

**Reference Books:**

- Montgomery and Runger, "Applied Statistics and Probability for Engineers", Wiley, India
- Pipes and Harvill, "Applied Mathematics for Engineers and Physicists".







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>II</b>	L	T	P	Credits
Course Code : <b>CCM1165</b>	Course Name: <b>Material Management</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>

**Course Description:**

The course deals with most costly resource for any project; Materials, materials consume about 60-70 % of project cost. This course will help students to find, procure, store, manage and utilize materials in an optimized manner. Students will also be familiar with international purchase, negotiation and decision making related to materials.

**Course Learning Outcomes:**

- After successful completion of the course, students will be able to,
1. Apply supplier selection methods.
  2. Produce optimal stores layout.
  3. Perform codification and classification.
  4. Perform material requirement planning.
  5. Apply inventory control techniques for materials management.

**Prerequisite:** Knowledge of the Construction Materials

<b>Course Content</b>		
Unit No.	Description	Hrs
1.	<b>Introduction:</b> Introduction, Need, Objectives and functions and scope of materials management. Integrated concept of materials management, Types of materials. Material management organization.	06
2.	<b>Purchase and Supply Chain Management:</b> Introduction, objectives and functions of purchasing. Types of purchasing purchase procedure, Supplier selection, supplier's evaluation and performance measurement, Vendor rating methods.	06
3.	<b>Stores Management and Control:</b> Classification, objectives and functions, Stores layout, Standardization and Codification, systems of codification. Purchase process and negotiation.	06
4.	<b>Break Even Analysis:</b> Introduction, Break even chart and Point, Computing Breakeven Point and margin of Safety, Graphical representation of BEP, Cost volume and profit analysis, Make or buy decision.	06
5.	<b>Inventory and Material Requirement Planning:</b> Introduction, Necessity, Types and functions of Inventory. Inventory costs, advantages and disadvantages of Inventory carrying. Inventory planning and control.	
	Systems, Introduction to MRP, M.R.P. system, Development of M. R. P.	06





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**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	M.R.P. Flow chart, Application of MRP.	
6.	<b>Inventory Control:</b> Introduction, Types of Inventory control Systems, Safety Stock, Essentials of Inventory control, Classification and characteristics of Inventory problems, Inventory control models I, II & III. Economic order quantity, EOQ Models.	06

**References:**

**Text Books:**

- Jhamb L. C., "Materials and Logistic Management", EPH Publisghing.
- Gopalkrishnan P. & M. Sundaresan, "Materials Management an Integrated Approach", PHI.
- Datta K., "Materials Management: Procedures, Text and Cases", PHI Learning Pvt. Ltd.
- Gopalakrishnan P., "Handbook of Materials Management", PHI Learning Pvt. Ltd.

**Reference Books:**

- C. M. Sadiwala, Ritesh C. Sadiwala, "Materials and Financial Management", New Age International Publishers.
- J. R. Tony Arnold, Stephen N. Chapman and Lloyd M. Clive, "Introduction to Materials Management", Pearson Publication.
- Arnold, "Introduction To Materials Management", Pearson Education India.
- Richard J. Tersine , "Principles Of Inventory and Materials ,Management", Prentice Hall.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b>	Semester: <b>II</b>	L	T	P	Credits
<b>Construction Management</b>					
Course Code : <b>CCM1180</b>	Course Name: <b>Advanced Construction Materials</b>	<b>3</b>	-	-	<b>3</b>

**Course Description:**

Materials play important role in projects; they cost around 60% of total project cost. Type and quality of materials will influence the performance and sustainability of construction. It is important to study new materials being developed by industry for application in project construction.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Justify the need of new material development.
2. Choose material for construction process based on material properties.

**Prerequisite:** Construction materials are important, student should be aware of basic properties of materials used in construction.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Introduction:</b> Necessity and importance of sustainable construction materials. Material composition and properties, production, storage, distribution, testing, acceptance criteria, limitations of use, economic consideration, recent development related to the following materials to be studied.	06
2.	<b>Construction Chemicals:</b> Various construction chemicals/admixtures , Fly ash and its use in concrete ,Silica fume concrete ,Self-compacting concrete, Fiber Reinforced plastics and concrete ,Light weight concrete.	06
3.	<b>Modified Materials:</b> Crumb modified bitumen Rubber, Glenium Concrete, Materials used in nuclear-containment structures.	06
4.	<b>High Performance Materials:</b> High performance concrete, Nano technology in cement concrete, Ferro cement Technology.	06
5.	<b>Ceramic Materials:</b> Classification, Refractories, glass, glass wool, mechanical, thermal and electrical properties, fire resistant materials, Uses and application New types of floor finishes and tiling, liquid granite.	06
6.	<b>Non Structural Materials:</b> Thermal insulation and acoustic absorption materials, Sound barriers used on motorway railways. Materials for intelligent buildings- Sensitile, aluminums radiant barriers, solar panel roof tiles, use of old jeans for roofing, flexi comb-electrical installation, kinetic glass, unfired clay bricks, richlite (recycled paper),carbon fibers.	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- Mehta P.K & Mantreio P.J.M, "Concrete Structure properties & Materials", Prentice hall.
- M L Gambhir, Neha Jamwal, "Building Materials", Tata McGraw Hill Publ.
- Neville, "Concrete Technology", Pearson publ..
- Dr. B.N.Divekar, "Ferrocement Construction Mannual", Ferrocete society of India Pune

**Reference Books:**

- William P Spence, Yesdee, "Construction Materials, Methods & Techniques".
- Ashby, M.F. and Jones. D.R., H.H., "Engineering Materials: An introduction to Properties, applications and designs", Elsevier Publications.
- Mamlouk, M.S. and Zaniewski, J.P., "Materials for Civil and Construction Engineers", Prentice Hall.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: II	L	T	P	Credits
Course Code : CCM1200	Course Name: <b>International Contracting</b>	3	-	-	3

**Course Description:**

For infrastructure development of various construction projects are required to be taken. These projects are executed by taking actual participation in contracting procedures. So in this course students will have different types of international terms and conditions which are useful for contracting.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Prepare tender documents as per international contracting procedures.
2. Apply of various conditions of international contract under the FIDIC document.
3. Understand the labour laws.
4. Act as arbitrator for dispute resolving.

**Prerequisite:** Basic knowledge of Environmental Engineering

**Course Content**

Unit No.	Description	Hrs
1.	<b>Contract Procedure and basic terminology:</b> Types of engineering contracts, Drafting a tender notice, Tender document, procedure of submission and award of tender, Mode of payments and necessity.	06
2.	<b>International contracting:</b> meaning, scope, nature, presents status of the International construction market, role of Asia- Pacific region countries in the present construction development. Impact of WTO/GATS on the Indian Construction Sector as regards domestic market and export sector. Selection of personnel to suit socio-economic-environmental culture in other countries, suitable organizational structure.	06
3.	<b>Study and application of various conditions of contract:</b> under the FIDIC document. Development of regulatory framework. Project exports from India. International financing, Various institutions such as WB, IMF, ADB. African bank etc. and their role, rules – regulations in funding various projects, forming alliance, bilateral and multilateral funding, trade practices etc.	06
4.	<b>International Projects:</b> Types of BOT systems such as BOT, BOOT, BOO, DBO, BOR, BLT, BRT, BTO & DBFOT, MOOT, ROO, ROT, BOLT – Contractual procedures, special features, methods of handling.	06
5.	<b>Documentation and Risk Identification:</b> Familiarization with construction documents, Certainty, Risk and Uncertainty, Risk	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	Management, Identification and Nature of Construction Risks, Contractual allocations of Risk, Types of risks.	
6.	<b>Disputes Resolution:</b> International Courts, formation of DRB's (Dispute resolving boards) functioning and experiences in India and abroad, Advantages of DRB's UNICTRAL Proceedings for International Arbitration. Institutionalized Arbitration, CIDC – SIAC Arbitration. CASE studies of any major project executed/functioning under International contracting.	06

**References:**

**Text Books:**

- FIDIC Documents-International federation of consulting Engineers.
- Simon M.S., "Construction Contracts & Claims", McGraw Hill, New York.
- Unified Contract Documents by Ministry of Statistics and program implementation, Government of India.
- Robert Matyas and Mathews, "Dispute Review Board Manual".

**Reference Books:**

- Karla C. Shippe, "A Short Course in International Contracts: Drafting the International Sales", World trade press.
- K. N. Vaid , "International Construction Contracting", NICMAR Publication







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: F.Y. M. Tech. <b>Construction Management</b>	Semester: II
Course Code : CCM1225	Course Name: <b>Research Methodology &amp; IPR</b>

L	T	P	Credits
2	-	-	2

**Course Description:**

This course is designed to make graduates aware of various steps involved in Research Process. Also report and research proposal writing is incorporated in the syllabus. This course also deals with IPR; its process and developments.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Prepare abstract through literature review.
2. Formulate a research problem.
3. Prepare and present research proposal/paper by following research ethics.
4. Prepare and present a report on Intellectual Property Rights.

**Prerequisite:** Nil

**Course Content**

Unit No.	Description	Hrs
1.	<b>Introduction:</b> Meaning of research problem, Sources of research problem, Criteria and Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.	04
2.	<b>Literature Study:</b> Effective literature studies approaches, Plagiarism, Research ethics, Approaches of investigation of solutions for research problem, Data collection, Data analysis with software, Interpretation, Necessary instrumentation's	04
3.	<b>Technical Writing:</b> Effective technical writing, How to write technical report and paper, Developing a Research Proposal, Format of research proposal, Presentation and assessment by a review committee.	04
4.	<b>Nature of Intellectual Property:</b> Patents, Designs, Trade and Copyright, Process of Patenting and Development: technological research, Innovation, Patenting development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.	04
5.	<b>Patent Rights:</b> Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.	04
6.	<b>New Developments in IPR:</b> Administration of Patent System, New developments in IPR; IPR of Biological Systems, Computer Software etc., Traditional knowledge Case Studies, IPR and IITs.	04





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**References:**

**Text Books:**

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students", Juta & Co Ltd.
- Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", SAGE Publication.
- Asimov, "Introduction to Design", Prentice Hall.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Wolters Kluwar.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand Publ.

**Reference Books:**

- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta Academic.
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd.
- Mayall, "Industrial Design", McGraw Hill Publication.
- Niebel, "Product Design", McGraw Hill Publication.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>II</b>
Course Code : <b>CCM1245</b>	Course Name : <b>Fundamentals of BIM Laboratory</b>

L	T	P	Credits
-	-	4	2

**Course Description:**

Upcoming and most related software for construction project management is evolved as Building Information Modeling (BIM), This course will help students to learn "Revit" and apply other futures to manage the project.

**Course Learning Outcomes:**

- After successful completion of the course, students will be able to,
1. Develop drawings as per software requirement.
  2. Compute quantities of building items.
  3. Develop project schedule using "Revit" application.

Course Content		
Experiment No.	Description	Hrs
1.	Learning Revit software.	16
2.	Learning 3D in Revit.	08
3.	Develop models using Revit.	08
4.	Take of quantities using Revit.	08
5.	Monitor project with virtual models.	08





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech. Construction Management</b>	Semester: <b>II</b>
Course Code : <b>CCM1265</b>	Course Name : <b>Primavera Laboratory</b>

L	T	P	Credits
-	-	4	2

**Course Description:**

Primavera software has the capacity to help plan, organize, and manage resource tools and develop resource estimates. Depending on the sophistication of the software, it can manage estimation and planning, scheduling, cost control and budget management, resource allocation, collaboration software, communication, decision-making, quality management and documentation or administration systems. Primavera is one of the computer based PM software used worldwide to handle construction projects. By this software complex civil engineering problems are handled. Primavera laboratory is designed to make graduates familiar with the current planning software used in industry; in this course students will acquire knowledge and expertise/hands-on in Primavera software.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Prepare schedule plan for construction project.
2. Analyze construction project using primavera.
3. Prepare and present various types of reports.

**Prerequisite:** Project Planning, Scheduling Techniques, Estimating & Costing.

**Course Content**

Experiment No.	Description	Hrs
1.	Learning basics of Primavera.	16
2.	Solving assignments given in Construction planning and control.	16
3.	Planning Scheduling of any two construction projects.	16







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>F.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>II</b>	L	T	P	Credits
Course Code : <b>CCM1285</b>	Course Name: <b>Mini project</b>	-	-	<b>4</b>	<b>2</b>

**Course Description:**

Mini project shall be delivered on one of the advanced topics chosen in consultation with the supervisor, based on dissertation work/societal problem/special structure. Here parametric study is not expected. Some lifelong learning abilities should be developed. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing single side printed, preferably in TRM format) should be submitted to the Department Post Graduate Committee (DPGC) before delivering the seminar. A copy of the report in soft form must be submitted to the supervisor, along with other details, if any. Minimum 03 presentations should be delivered by the students.

**Prerequisite:** Basics of Research Methodology.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Select mini project problem.
2. Prepare and present statement of purpose.
3. Develop solution to the selected problem.
4. Prepare and present report related to project undertaken.

**Course Content**

Description	Hrs
The topic for the Mini projects may be related to Civil Construction Management area and interdisciplinary area related to Civil Engineering or an innovative idea; Student should perform analysis/design work. Student should prepare model of their work. Evaluation of Mini projects report will be done by the DPGC Committee at the end of semester I.	48





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class:- F.Y. M. Tech. <b>Construction Management</b>	Semester: II	L	T	P	Credits
Course Code : SHP552	Course Name : <b>Framework of Indian Constitution</b>	02	-	-	<b>Audit Course</b>

**Course Description:** This course is designed to help students to know the constitution of India. It draws a limit on the power of the Government by outlining a framework within which the Government must function. They act as a bedrock to democracy as they guarantee equality to the citizens of the nation. Due to the principle of equality, one can ensure dignity and respect in the country. These rights apply to a man as a protection against his will and expression. Union has jurisdiction over subjects of national importance such as defence of the country, foreign affairs, banking, communications, and currency and also subjects present in concurrent list. States have jurisdiction over education, agriculture, public health, sanitation, hospitals and dispensaries and many other departments. The state governments also have to maintain the internal security, law and order in the state.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
2. Identify the importance of fundamental rights as well as fundamental duties
3. Understand the functioning of Union, State and Local Governments in Indian federal system
4. Learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

**Prerequisite:** NIL

**Course Content**

Unit No	Description	Hrs
1.	<b>Introduction to Constitution:</b> Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties -their enforcement and their relevance	06
2.	<b>Union Government:</b> Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions.	06
3.	<b>State and Local Governments:</b> State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. with special reference to 74th Amendment.	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

4.	<b>Election provisions, Emergency provisions, Amendment of the constitution:</b> Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.	06
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**References:**

**Text Books:**

- M.V.Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication.
- Durga Das Basu (DD Basu), "Introduction to the constitution of India, Prentice-Hall EEE.

**Reference Books:**

- Merunandan, "Multiple Choice Questions on Constitution of India", Meraga publication.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**Open Elective**

Class: S. Y. M. Tech	Semester- III	L	T	P	Credits
Course Code: MOE2011	Course Name: Artificial Intelligence - Machine Learning	3	-	-	3

**Course Description:**

Machine learning is a part of Artificial Intelligence. It uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention. Machine learning as a field is now incredibly pervasive, with applications spanning from business intelligence to homeland security, from analyzing biochemical interactions to structural monitoring of aging bridges, and from emissions to astrophysics, etc. This class will familiarize students with a broad cross-section of models and algorithms for machine learning and prepare students for research or industry application of machine learning techniques.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Describe central machine learning methods and techniques and how they relate to artificial intelligence
2. Differentiate between supervised and unsupervised learning techniques
3. Apply the ML algorithms to a real-world problem,
4. Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
5. Evaluate a given problem and apply appropriate machine learning technique

**Prerequisite:** Statistics, linear algebra, optimization techniques, programming language

**Course Content**

Unit No	Description	Hrs
1.	<b>Introduction to Artificial Intelligence and Machine learning:</b> Introduction: What Is AI and ML? Examples of AI and ML, Applications, Supervised Learning, Un-Supervised Learning and Reinforcement Learning, Important Elements of Machine Learning- Data formats, Learnability, Statistical learning approaches, Elements of information theory	06
2.	<b>Feature Selection:</b> Scikit- Learn Dataset, Creating training and test sets, managing categorical data, Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principle Component Analysis(PCA)- non-negative matrix factorization, Sparse PCA, Kernel	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	PCA. Atom Extraction and Dictionary Learning.	
3.	<b>Regression:</b> Linear regression- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Polynomial regression, Logistic regression-Linear classification, Logistic regression, Implementation and Optimizations, Stochastic gradient descent algorithms	06
4.	<b>Naïve Bayes and Support Vector Machine:</b> Bayes Theorem, Naïve Bayes Classifiers, Naïve Bayes in Scikit-learn- Bernoulli Naïve Bayes, Multinomial Naïve Bayes, and Gaussian Naïve Bayes. <b>Support Vector Machine(SVM)-</b> Linear Support Vector Machines, Scikit-learn implementation, Linear Classification, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.	06
5.	<b>Decision Trees and Ensemble Learning:</b> Decision Trees- Impurity measures, Feature Importance. Decision Tree Classification with Scikit learn, Ensemble Learning-Random Forest, AdaBoost, Gradient Tree Boosting, Voting Classifier. Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index.	04
6.	<b>Clustering Techniques:</b> Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering Dendrograms, Agglomerative clustering in Scikit-learn, Connectivity Constraints. Introduction to Recommendation Systems- Naïve User based systems, Content based Systems, Model free collaborative filtering-singular value decomposition, alternating least squares.	08

**References :**

**Text Books:**

- Giuseppe Bonaccorso, Machine Learning Algorithms, Packt Publishing Limited.
- Josh Patterson, Adam Gibson, Deep Learning: A Practitioners Approach, O'REILLY, SPD.

**Reference Books:**

- Ethem Alpaydin, Introduction to Machine Learning, PHI.
- Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**Open Elective**

Class:- S. Y. M. Tech	Semester-III	L	T	P	Credits
Course Code : MOE2021	Course Name : Creative Thinking: Techniques &Tools	3	-	-	3

**Course Description:**

In today's ever-growing and changing world, being able to think creatively and innovatively are essential skills. It can sometimes be challenging to step back and reflect in an environment which is fast paced or when students required to assimilate large amounts of information. Making sense of or communicating new ideas in an innovative and engaging way, approaching problems from fresh angles, and producing novel solutions are all traits which are highly sought after by employers. This course will equip with a 'tool-box', introducing to a selection of behaviors and techniques that will augment innate creativity. Some of the tools are suited to use on own and others work well for a group, enabling you to leverage the power of several minds. People can pick and choose which of these tools or techniques suit needs and interests, focusing on some or all of the selected approaches and in the order that fits best.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Comprehend importance in tackling global challenges as well as in everyday problem-solving scenarios
2. Apply different brainstorming techniques in group activities
3. Be proficient in the application of the 6 thinking hats tool in different life scenarios
4. Develop a systematic approach to idea generation through the use of morphological analysis
5. Innovate on an existing product, service or situation applying the SCAMPER method
6. Get confident with the theory of inventive problem solving, called TRIZ

**Prerequisite:** There are no prerequisites to this course.

**Course Content**

Unit No	Description	Hrs
1.	<b>Introduction to the Principles of Creativity:</b> Basic principles of creativity and highlight its importance in tackling global challenges. Creativity is explored and applied at two different levels, lower and higher-level creativity	06
2.	<b>Creativity Tools:</b> Augment our creativity using different methods of Brainstorming, a creativity approach that aids the generation of ideas in	06







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	solving a stated problem. Particularly focus on the application of brainstorming tools in group activities, with the aim of enabling to understand, evaluate and apply different types of brainstorming techniques in own context.	
3.	<b>Six Thinking Hats:</b> Principles as well as application of the 6 Hats thinking tool both at an individual level and in a group, under various professional and personal situations, allowing students to develop competency and accelerate proficiency on the use of technique.	06
4.	<b>Clarifying the Problem:</b> Organizing a process, turning problems into opportunities, facts, feelings & hunches, problem as question.	06
5.	<b>Generating Ideas:</b> Brainstorming, scamper, forced connections, portable think tank, case studies on generating ideas.	06
6.	<b>Developing Ideas &amp; Planning for action:</b> Organizing ideas, ideas to solutions, implementing solutions, case studies of development of ideas and plan of action.	06

**References:**

**Text Books:**

- Michael Michalko, Thinkertoys: A Handbook of Creative-Thinking Techniques, second edition, Ten Speed Press.
- Michael Michalko, Cracking Creativity: The Secrets of Creative Genius, revised edition, Ten Speed Press.
- Edward de Bono, Penguin, Lateral Thinking: A Textbook of Creativity.
- Edward de Bono, Penguin, Six Thinking Hats.

**Reference Books:**

- New World Library, Creative Thinkering: Putting Your Imagination to Work,
- Chris Griffiths, Kogan Page, The Creative Thinking Handbook: Your Step by Step Guide to Problem Solving in Business.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**Open Elective**

Class: - S. Y. M. Tech.	Semester-III	L	T	P	Credits
Course Code : MOE2031	Course Name : MOOC Course	3	-	-	3

**Course Description:**

Student can opt for online certification course and produce certificate.

- The students who are doing course on MOOC/NPTEL Course /Courses suggested by DPGC should select the course in consultation with supervisor and submit the details to Head of Program.
- The course should be minimum 25 hours duration and should have certification facility.
- Student should complete course and get certificate. The certificate copy should be submitted to head of program with supervisor signature.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Identify the real applications and practices of courses studied, at industry level
2. Recognize various modelling, analysis and validation techniques adopted at industries.
3. Demonstrate the issues at design, manufacturing and assembly levels.
4. Summarize and present technical data in report format.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**Open Elective**

Class:- S. Y. M. Tech	Semester-III	L	T	P	Credits
Course Code: MOE2041	Course Name: <b>Condition Monitoring and Signal Processing</b>	3	-	-	3

**Course Description:**

The subject of condition monitoring and signal processing has been recently receiving considerable attention in India owing to concerns related to equipment reliability and safety. This increasing interest is primarily due to the significant impact of economic changes and strong competition in the global market. This course will provide students with the state of the art techniques in condition monitoring along with the recent developments in the field of signal processing, thermography, ultrasonics apart from the traditional noise and vibration monitoring. There will be demonstration of real-time machinery health monitoring by various condition monitoring aspects.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors.
2. Analyze for machinery condition monitoring and explain how this compliments monitoring the condition.
3. Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.
4. Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.
5. Identify vibration measurement, lubrication oil analysis.

**Prerequisite:** Mechanical Vibration

**Course Content**

Unit No	Description	Hrs
1.	<b>Introduction:</b> Introduction to condition based maintenance, application and economic benefits. Typical defects in gears and rolling element bearings Vibrations of Gears and Bearings, Vibration characteristics of non-defective gears; Vibration characteristics of non-defective bearings; Vibration characteristics of defective gears; Vibration characteristics of defective bearings.	06
2.	<b>Monitoring Methods:</b> Early time domain methods, spectral methods, cepstral methods, envelope methods. Vibration Analysis: Vibration- simple harmonic motion concept, vibration monitoring equipment, system monitors and vibration limit detectors, vibration monitoring examples, and critical vibration	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	levels.	
3.	<b>Sound Monitoring:</b> Sound frequencies, sound loudness measurement, acoustic power, sound measurement, sound level meters, sound analyzers, and sound signal data processing, sound monitoring.	06
4.	<b>Discrete Frequencies:</b> Simple vibrations, transverse vibration of bars approximate frequency calculations, more precise evaluations- overtones, torsional oscillation of flywheel-bearing shafts, belt drives, whirling of shafts, gear excitation, rolling element bearing, blade vibration, cam mechanism vibration.	06
5.	<b>Machine Condition Indicators:</b> RMS value, peak value and crest factor, kurtosis, defect severity index. Measurement Techniques: Instrumentation, data acquisition, signal filtering, signal analysis - online and offline techniques, normalized order analysis.	06
6.	<b>Signal Processing Tools:</b> Sample rate and aliasing, time and frequency domain analysis. Case Studies: Practical applications of diagnostic maintenance, condition monitoring of mechanical and electrical machines. (Rotating Machines, Bearings and Gears, Fans, Blowers, Pumps, IC Engines, Motor Current Signature Analysis, Wear Debris and Oil Analysis, NDT, Ultrasonics, Eddy Current)	06

**References:**

**Text Books:**

- Norton, M. P., and Karczub, D. Fundamentals of Noise and Vibration Analysis for Engineers. Cambridge University Press.
- Collacott, R. A. Mechanical Fault Diagnosis and Condition Monitoring. Chapman and Hall.
- Fahy, F. J., and Walker, J. G. Fundamentals of Sound and Vibration. Spon Press.
- Mohanty, A. R. Machinery Condition Monitoring: Principles and Practices. CRC Press.
- Isermann, R. Fault Diagnosis Applications. Springer-Verlag, Berlin.
- Rao, J. S. Vibration Condition Monitoring. Narosa Publishing House.
- M. Abom, M. Sound and Vibration. KTH.

**Reference Books:**

- Davies, A, Handbook of Condition Monitoring- Techniques and Methodology. Springer.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Open Elective

Class:- S.Y. M. Tech.	Semester-III
Course Code : MOE2051	Course Name : Aircraft Conceptual Design

L	T	P	Credits
3	-	-	3

**Course Description:**

This course elaborates the aircraft conceptual design process. It is a combination of numerous disciplines which are combined together to give optimum configuration as per customer's requirements. Students can design their aircraft layout, choose power plant, and decide wing area and type. Students can evaluate lift, drag and mass for aircraft design synthesis process. He can optimize the design by altering various influencing factors so that the aircraft can go for next phase of design i.e. preliminary design.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Analyze the design process of aircraft and decide the aircraft configuration.
2. Choose type of power plant as per flight regime.
3. Design the fuselage layout as per type of aircraft.
4. Design the wing for type of aircraft and its wing loading
5. Evaluate lift, drag and mass for design synthesis.
6. Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.

**Course Content**

Unit No	Description	Hrs
1.	<b>Design Process and Aircraft Configuration:</b> Aircraft design process, cost considerations, optimization, and synthesis process. Conventional configuration, alternative configurations, special considerations.	06
2.	<b>Flight Regime and Power plant Consideration :</b> Power plant characteristics, types of powerplant, typical engine parameters, flight regimes of power plants, power plant performance representation.	06
3.	<b>Fuselage Layout:</b> Primary considerations, overall layout, local layout aspects, crew and payload, fuselage procedures.	06
4.	<b>Configuration of the Wing:</b> Aerofoil section and high lift devices, planform shape and geometry, interaction between aerodynamic structure and wing volume considerations, wing loading.	06
5.	<b>Basic Lift, Drag and Mass Representation:</b> Lift: aircraft configurations, initial assumptions, moderate to high aspect ratio wing configurations, low aspect ratio wing configuration. Drag: subsonic and transonic aircraft,	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	transonic and supersonic configurations. Mass: absolute mass contributions, variable mass contributions, total mass.	
6.	<b>Parametric Analysis and Optimization:</b> Procedure for parametric analysis (first stage), powerplant representation, selection of performance equations, constraints and checks, case study: short/medium haul airliner. Procedure for parametric analysis and optimization (second stage), mass calculation, wing location and control surface areas, overall layout of the aircraft, case study: short/medium haul airliner.	06

**References:**

**Text Books:**

- Denis Howe, Aircraft Conceptual Design Synthesis, John Wiley & Sons
- John Cutler, Understanding Aircraft Structures, WILEY Blackwell

**Reference Books:**

- A.C. Kermode, Mechanics of Flight, Person Education.
- Ian Moir & Allan Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, John Wiley & Sons







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**Open Elective**

Class: - S. Y. M. Tech.	Semester - III	L	T	P	Credits
Course Code: MOE2060	Course Name: <b>Augmented Reality and Virtual Reality</b>	3	-	-	3

**Course Description:**

This course presents an introduction to virtual and augmented reality technologies, with an emphasis on designing and developing interactive virtual and augmented reality experiences. The course will cover the history of the area, fundamental theory, and interaction techniques. Students are provided with hands-on experience developing applications for modern virtual and augmented reality systems. In the course, students will also explore libraries and tools for creating AR/VR experiences such as Vuforia and UNITY.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to:

1. Define the basic concepts of Virtual and Augmented Reality
2. Identify the differences in AR/VR concepts and technologies
3. Describe the fundamental concepts relating to Virtual Reality such as presence, immersion, and engagement
4. Evaluate usability of AR/VR applications and critique their use of AR/VR capabilities
5. Design and prototype effective AR/VR applications using UNITY platform for various application.

**Prerequisites:** Programming and Data Structures

**Course Content**

Unit No	Description	Hrs
1.	<b>Introduction to Augmented Reality:</b> Definition and Scope , Brief History of Augmented Reality, Displays (Multimodal Displays, Spatial Display Model, and Visual Displays) ,Strong vs Weak ,AR Applications AR Challenges in AR.	06
2.	<b>Introduction to Virtual Reality:</b> Definition and Scope, Types of VR Characteristics, Basic VR environments, Limitations of VR environments, Immersion Vs Presence.	06
3.	<b>Interaction design for AR/VR environments:</b> Interaction design process Identifying user needs, AR/VR design considerations Typical AR/VR Interface Metaphors, User experience (UX) guidelines for AR/VR, UX challenges for AR/VR, Prototyping for AR/VR, Evaluation of the developed AR/VR prototype	06
4.	<b>Introduction to UNITY :</b> Unity Overview: Windows, Interface, Navigation, Terminology, Game Objects, Hierarchy, Parenting Objects, Asset Store, Importing Plug-ins, Creating a Terrain, Materials, Colors, Transparency,	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	Introduction to Mono behaviours: Awake, Start, Update	
5.	<b>Introduction to Vuforia and Physics in UNITY:</b> Vuforia Overview: Interface, Navigation, Terminology, Image Targeting, Custom Images, Overview of Physics in Unity, Introduction to Scripting: Terminology, Creating Objects, Accessing Components, Debugging, Lists, Loops	06
6.	<b>Expanding on Scripting and Interaction:</b> Creating Trigger Events, Manipulating Components in Scripts, Programming Interactions between Objects and Tracked Images in AR, designing a simple User Interface in AR, Introduction to colliders and their use: On Collision Enter, On Collision Exit. On Collision Stay, On Trigger vs On Collision, Rigid bodies and how Colliders report to them.	06

**References:**

**Text Books:**

- Vince, "Virtual Reality Systems", Pearson Education.
- Grigore Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley.
- Schmalstieg, D., & Hollerer, T. Augmented reality: principles and practice. Addison-Wesley Professional.

**Reference Books:**

- Azuma, R.T. A survey of augmented reality. Presence: Teleoperators & Virtual Environments, 6(4), 355-385.
- Azuma, R., Baillet, Y., Behringer, R., Feiner, S., Julier, S., & MacIntyre, B. Recent advances in augmented reality. IEEE computer graphics and applications, 21(6), 34-47.
- Bhagat, K. K., Liou, W.-K., & Chang, C.-Y. A cost-effective interactive 3D virtual reality system applied to military live firing training. Virtual Reality, 20(2), 127-140. doi:10.1007/s10055-016-0284-x
- Carmigniani, J., Furht, B., Anisetti, M., Ceravolo, P., Damiani, E., & Ivkovic, M. Augmented reality technologies, systems and applications. Multimedia tools and applications, 51(1), 341-377.
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- Schuemie, M. J., Van Der Straaten, P., Krijn, M., & Van Der Mast, C. A. Research on presence in virtual reality: A survey. CyberPsychology & Behavior, 4(2), 183-201.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**Open Elective**

Class:- S. Y. M. Tech	Semester-III
Course Code : MOE2070	Course Name : <b>Industrial Instrumentation</b>

L	T	P	Credits
3	-	-	3

**Course Description:**

This course is an overview of the principles, concepts, and applications of process transmitters found in an industrial plant. Continuous measurement and control of all the parameters will be emphasized. Also practical installation and calibration procedures of various types of sensors and transducers will be covered. Open and closed loop control systems will also be discussed, including such concepts as on/off control, set point, overshoot, undershoot, gain, feedback, PID loops, and reverse/direct acting systems.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Elaborate working principal of different transducers.
2. Select suitable transducer/sensor for specific application.
3. Justify the use of specific measurement technique for specific task.
4. Evaluate the Calibration and Interfacing of the transducers.

**Prerequisite:** Basic knowledge of sensor and measurement

**Course Content**

Unit No	Description	Hrs
1.	<b>Metrology:</b> Measurement of length – Gauge blocks – Plainness – Area using Simpson's rule, Plain meter – Diameter – Roughness – Angle using Bevel protractor, sine bars and Clinometer – Mechanical, Electrical, Optical and Pneumatic Comparators. Optical Methods for length and distance measurements using Optical flats and Michelson Interferometer.	06
2.	<b>Velocity and Acceleration Measurement:</b> Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers – Magnetic and Photoelectric pulse counting stroboscopic methods. Accelerometers-different types, Gyroscopes-applications.	06
3.	<b>Force and Pressure Measurement:</b> Force measurement – Different methods – Gyroscopic Force Measurement – Vibrating wire Force transducer. Basics of Pressure measurement – Manometer types – Force-Balance and Vibrating Cylinder Transducers – High and Low Pressure measurement – McLeod Gauge, Knudsen Gauge, Momentum Transfer Gauge, Thermal Conductivity Gauge, Ionization Gauge, Dual Gauge Techniques, Deadweight Gauges,	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	Hydrostatic Pressure Measurement	
4.	<b>Flow Measurement and Level Measurement:</b> Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, mass flow meter, ultrasonic type, vortex shedding type, Hotwire anemometer type, Laser Doppler Velocity-meter. Basic Level measurements – Direct, Indirect, Pressure, Buoyancy, Weight, Capacitive Probe methods	06
5.	<b>Density, Viscosity and Other Measurements:</b> Density measurements – Strain Gauge load cell method – Buoyancy method – Air pressure balance method – Gamma ray method – Vibrating probe method. Units of Viscosity, specific gravity scales used in Petroleum Industries, Different Methods of measuring consistency and Viscosity –Two float viscorator –Industrial consistency meter. Sound-Level Meters, Microphones, Humidity Measurement	06
6.	<b>Calibration and Interfacing:</b> Calibration using Master Sensors, Interfacing of Force, Pressure, Velocity, Acceleration, Flow, Density and Viscosity Sensors, Variable Frequency Drive. Open and closed loop control system with on/off control, setpoint, overshoot, undershoot, gain, feedback, PID loops, and reverse/direct acting systems.	06

**References:**

**Text Books:**

- Doebelin E.O., "Measurement Systems – Applications and Design", McGraw Hill International.
- Patranabis D, "Principles of Industrial Instrumentation", Tata McGraw Hill.

**Reference Books:**

- Considine D. M., "Process Instruments and Control Handbook", McGraw Hill International.
- Jain R.K., "Mechanical and Industrial Measurements", Khanna Publications.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

**Open Elective**

Class:- S. Y. M. Tech	Semester-III
Course Code: MOE2080	Course Name: <b>Advanced Mechatronics Systems</b>

L	T	P	Credits
3	-	-	3

**Course Description:**

The course will be helpful to provide overview of mechanical and electronic systems used in industrial atmosphere. This will be helpful for upcoming automation in industry. Mechatronics is a multidisciplinary field of science that includes a combination of Mechanical Engineering, Electronics, Computer Engineering, Telecommunications Engineering and Control Engineering. Mechatronics is a multi-disciplinary study dealing with the integration of mechanical devices, actuators, sensors, electronics, intelligent controllers and computers. Mechatronics generally involves

- (i) implementing electronics control in a mechanical system
- (ii) enhancing existing mechanical design with intelligent control and
- (iii) replacing mechanical component with an electronic solution.

This course will cover all aspects related with mechatronics such as sensors and transducers, actuators and mechanisms, signal conditioning, microprocessors and microcontrollers, modeling & system response and design of mechatronics systems.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Explain Mechatronics System
2. Analyze the Mechatronics Based System
3. Model, simulate, and verify the mechatronics systems.
4. Identify Electrical, Hydraulic and Pneumatic Components.

**Prerequisite:** Basic knowledge of research related activities.

**Course Content**

Unit No.	Description	Hrs
1.	<b>Introduction:</b> What is Mechatronics, Integrated Design Issues in mechatronics, Mechatronics Design Process, Mechatronics Key elements, applications in mechatronics.	06
2.	<b>Modelling and Analysis of Mechatronics Systems:</b> Block Diagram Modelling, Analogy approach, Impedance Diagrams, Electrical Systems, Mechanical systems and electromechanical systems. Mass-Spring-Oscillation and Damping system, Dynamic response of systems, Transfer function and	06





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

	frequency response. Labview, MATLAB, Scilab	
3.	<b>Sensors and Actuators</b> : Performance terminology of sensors, Displacement, Position & Proximity Sensors, Displacement, Position sensors, Force, Fluid pressure, Liquid flow sensors, temperature, light sensor, Acceleration and Vibration measurement, Electrical and Mechanical Actuation Systems.	06
4.	<b>Signal Conditioning:</b> Introduction to signal processing, Op-Amp as signal conditioner, Analogue to Digital Converter, Digital to Analogue Converter, Signal processing devices, relays, contactors and timers. Microcontrollers, PID controllers and PLCs.	06
5.	<b>Hydraulic system and Pneumatic system:</b> Flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps, Pneumatic system components and graphic representations, Advantages and limitations of pneumatic systems.	06
6.	<b>Case Study:</b> List of various mechatronics systems, Case study of pick and place mechanism of robotic arm using pneumatic power, Hydraulic circuit for CNC Lathe machine, 3D Printer, Auto-control system for Green House Temperature and Auto-focusing in Digital Cameras.	06

**References:**

**Text Books:**

- Bradley, D. Dawson, N.C.Burd and A.J. Loader, "Mechatronics: Electronics in product and process", Chapman and Hall, London.
- Devadas Shetty, Richard A.Kolkm, "Mechatronics system design, PWS publishing company.
- David G. Alciatore, Michael B. Histan, "Introduction to mechatronics and measurement systems" Mc Graw Hill Education.

**References Books:**

- Intelligent Mechatronic Systems: Modeling, Control and Diagnosis, R. Merzouki, A. K. Samantaray, P. M. Pathak, B. Ould Bouamama, Springer, London.
- Technical website: [https://onlinecourses.nptel.ac.in/noc21\\_me27/course](https://onlinecourses.nptel.ac.in/noc21_me27/course)







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>S.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>III</b>	L	T	P	Credits
Course Code : <b>CCM2015</b>	Course Name: <b>Industry Internship</b>	-	-	2	<b>Audit Course</b>

**Course Description:**

The course has been introduced so as to give exposure of industry culture and various tasks and departments in the industry. Students will be inducted through the training program and will be able to relate theory and its applications in the industry.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Relate theory to practice.
2. Compile technical data of the project.
3. Prepare daily work reports of ongoing activities.
4. Prepare and present internship report.

In the industry training work, the student is expected to undergo training in industry, related to subject specialization for duration of 21 days (minimum) for at least 6 hrs. Per day. Student should write a report on the industry training and submit to department for ISE evaluation at the beginning of third semester. Student should include the certificate from company regarding satisfactory completion of the industry training.	90
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**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: S.Y. M. Tech. Construction Management	Semester: III	L	T	P	Credits
Course Code : CCM2035	Course Name: Dissertation Phase-I	-	-	8	4

**Course Description:**

**Synopsis approval presentation:**

Under the guidance of faculty called as 'Supervisor', PG student from second year is required to do innovative and research oriented work related to various theory and laboratory courses he/she studied during previous semesters. Dissertation work should not be limited to analytical formulation, experimentation or software based project. Student can undertake an interdisciplinary type project with the prior permission of DPGC from both departments.

**Synopsis:**

Student need to carry out exhaustive literature survey with consultation of his/her supervisor for not less than 25 reputed national international journal and conference papers. Student should make the Synopsis Submission Presentation (SSP) with literature survey report to DPGC and justify about the innovativeness, applicability, relevance and significance of the work. At the time of presentation, student shall also prepare Synopsis of the work and submit to department for approval. Student shall submit synopsis of dissertation as per the prescribed format in 02 copies to department.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Select research problem through literature survey.
2. Develop research design for research problem.
3. Prepare and present synopsis report.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>S.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>III</b>	L	T	P	Credits
Course Code : <b>CCM2055</b>	Course Name: <b>Dissertation Phase-II</b>	-	-	<b>12</b>	<b>6</b>

**Course Description:**

Phase II evaluation is based on End Semester Examination (ESE) which is based on the work during the semester. It is expected that student shall present preliminary results from his/her work during the semester with report as per prescribed format. DPGC including 1 external examiner as expert will approve the report and progress of student.

ISE will be evaluated by DPGC and ESE will be evaluated by DPGC and one external expert. Student will submit a report (soft bound before 1 week of date of presentation) as per prescribed format and present to DPGC for ISE and ESE. If student is not showing satisfactory performance, then he/she will be given grace period of two weeks. After two weeks' student will be again evaluated with grade penalty.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Perform data/experimental data collection for the project.
2. Analyze collected data using appropriate tools/techniques/ software.
3. Perform experimental/software analysis for validation of research work.
4. Prepare and present report.





**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>S.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>IV</b>	L	T	P	Credits
Course Code : <b>CCM2025</b>	Course Name: <b>Dissertation Phase-III</b>	-	-	12	6

**Course Description:**

Student is required to give a presentation on the progress of his/her dissertation work in front of supervisor and DGPC. It is expected that up to this stage almost 90% of dissertation work is almost completed. Student will make the presentation and seek the suggestions from the supervisor and DPGC. Supervisor and DPGC will ensure that work carried out by the student till this stage is satisfactory and in compliance with synopsis of the dissertation submitted by student. This is In Semester Evaluation (ISE).

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Analyze collected data using appropriate tools/techniques/ software's.
2. Prepare and present/publish technical paper.
3. Prepare and present report.







**M. Tech. Construction Management Syllabus**  
To be implemented for 2023-25 & 2024-26 Batch (NEP 2020)

Class: <b>S.Y. M. Tech.</b> <b>Construction Management</b>	Semester: <b>IV</b>	L	T	P	Credits
Course Code : <b>CCM2045</b>	Course Name: <b>Dissertation Phase IV</b>	-	-	20	10

**Course Description:**

In Dissertation Phase-IV, it is expected that student should complete

1. 100% implementation of the proposed system.
2. Simulation/ experimentation work on the proposed system.
3. Performance evaluation of the proposed system.
4. Comparison of the proposed system with existing systems.
5. Writing of the conclusion.
6. Preparation of a draft-copy of the dissertation report with plagiarism report.

**Course Learning Outcomes:**

After successful completion of the course, students will be able to,

1. Compile the work done in appropriate sequence.
2. Derive conclusion of the work done of the project.
3. Analyze proposed system.
4. Perform plagiarism analysis of compiled report.
5. Prepare and present the final dissertation report in desired format.

