

KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA



REGULATIONS, CURRICULUM & SYLLABI - 2020

**(CHOICE BASED CREDIT SYSTEM AND
OUTCOME BASED EDUCATION)**

(For the students admitted during 2020 - 2021 and onwards)

MASTER OF ENGINEERING DEGREE IN CONSTRUCTION ENGINEERING AND MANAGEMENT

DEPARTMENT OF CIVIL ENGINEERING





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VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Provide value based quality education for developing the student as a competent and responsible citizen.
- Contribute to the nation and beyond through the state-of-the-art technology.
- Continuously improve our services.

DEPARTMENT OF CIVIL ENGINEERING

VISION

To become a center of excellence to meet the global challenges in the diversified field of Civil Engineering.

MISSION

Department of Civil Engineering is committed to:

- MS1: To impart quality education through effective teaching learning methods
- MS2: To encourage students to pursue research activities and to collaborate with industries to promote consultancy activities.
- MS3: To develop engineers who can participate in the technical advancement and social upliftment of the society

2020 REGULATIONS

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Construction Engineering and Management will

- PEO1: Competent in construction management to apply engineering and management principles to address the global challenges.
- PEO2: Be able to plan and execute projects with optimum resources by the use of advanced management techniques.
- PEO3: Have commitment to engage in continual learning to fulfill the industrial and societal needs with professional ethics.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs



MS\PEO	PEO1	PEO2	PEO3
MS1	3	3	2
MS2	2	3	3
MS3	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)	
Construction Engineering and Management Post Graduates will be able to:	
PO1	Independently carry out research /investigation and development work to solve practical problems
PO2	Write and present a substantial technical report/document
PO3	Understand the requirement of the industry and perform effectively with the managerial skills
PO4	Schedule construction projects with the aid of software's
PO5	Apply advanced techniques and practices in construction projects

MAPPING OF PEOs WITH POs

PEO\PO	PO1	PO2	PO3	PO4	PO5
PEO1	3	2	3	2	3
PEO2	2	2	3	3	3
PEO3	2	2	3	2	3

1 – Slight, 2 – Moderate, 3 – Substantial



KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(An Autonomous Institution Affiliated to Anna University)

REGULATIONS 2020

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

MASTER OF ENGINEERING (ME) / MASTER OF TECHNOLOGY (MTech) DEGREE PROGRAMMES

These regulations are applicable to all candidates admitted into ME/MTech Degree programmes from the academic year 2020 – 2021 onwards.

1. DEFINITIONS AND NOMENCLATURE

In these Regulations, unless otherwise specified:

- i. “University” means ANNA UNIVERSITY, Chennai.
- ii. “College” means KONGU ENGINEERING COLLEGE.
- iii. “Programme” means Master of Engineering (ME) / Master of Technology (MTech) Degree programme
- iv. “Branch” means specialization or discipline of ME/MTech Degree programme, like Construction Engineering and Management, Information Technology, etc.
- v. “Course” means a Theory / Theory cum Practical / Practical course that is normally studied in a semester like Engineering Design Methodology, Machine Learning Techniques, etc.
- vi. “Credit” means a numerical value allocated to each course to describe the candidate’s workload required per week.
- vii. “Grade” means the letter grade assigned to each course based on the marks range specified.
- viii. “Grade point” means a numerical value (0 to 10) allocated based on the grade assigned to each course.
- ix. “Principal” means Chairman, Academic Council of the College.
- x. “Controller of Examinations” means authorized person who is responsible for all examination related activities of the College.
- xi. “Head of the Department” means Head of the Department concerned of the College.



2. PROGRAMMES AND BRANCHES OF STUDY

The following programmes and branches of study approved by Anna University, Chennai and All India Council for Technical Education, New Delhi are offered by the College.

Programme	Branch
ME	Construction Engineering and Management
	Structural Engineering
	Engineering Design
	Mechatronics Engineering
	VLSI Design
	Embedded Systems
	Power Electronics and Drives
	Control and Instrumentation Engineering
	Computer Science and Engineering
MTech	Information Technology
	Chemical Engineering
	Food Technology

3. ADMISSION REQUIREMENTS

Candidates seeking admission to the first semester of the ME/MTech Degree programme shall be required to have passed an appropriate qualifying Degree Examination of Anna University or any examination of any other University or authority accepted by the Anna University, Chennai as equivalent thereto, subject to amendments as may be made by the Anna University, Chennai from time to time. The candidates shall also be required to satisfy all other conditions of admission prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

4. STRUCTURE OF PROGRAMMES

4.1 Categorisation of Courses

The ME / MTech programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester and project work, internship, etc that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

- i. Foundation Courses (FC)



- ii. Professional Core (PC) Courses
- iii. Professional Elective (PE) Courses
- iv. Open Elective (OE) Courses
- v. Employability Enhancement Courses (EC) like Innovative Project, Internship cum Project work in Industry or elsewhere, Project Work

4.2 Credit Assignment

Each course is assigned certain number of credits as follows:

Contact period per week	Credits
1 Lecture / Tutorial Period	1
2 Practical Periods	1
2 Project Work Periods	1
40 Training /Internship Periods	1

The minimum number of credits to complete the ME/MTech programme is 72.

4.3 Employability Enhancement Courses

A candidate shall be offered with the employability enhancement courses like innovative project, internship cum project work and project work during the programme to gain/exhibit the knowledge/skills.

4.3.1 Innovative Project

A candidate shall earn two credits by successfully completing the project by using his/her innovations in second semester during his/her programme.

4.3.2 Internship cum Project Work

The curriculum enables a candidate to go for full time internship during the third semester and can earn credits through it for his/her academics vide clause 7.6 and clause 7.12. Such candidate shall earn the minimum number of credits as mentioned in the third semester of the curriculum other than internship by either fast track mode or through approved courses in online mode or by self study mode. Such candidate can earn the number of credits for the internship same as that of Project Work in the third semester. Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.

4.3.4 Project Work

A candidate shall earn nine credits by successfully completing the project work in fourth semester during the programme inside the campus or in industries.

4.4 Value Added Courses / Online Courses / Self Study Courses

The candidates may optionally undergo Value Added Courses / Online Courses / Self Study Courses as elective courses.

4.4.1 Value Added Courses: Value Added courses each with One / Two credits shall be offered by the college with the prior approval from respective Board of Studies. A candidate can earn a maximum of three credits through value added courses during the entire duration of the programme.



4.4.2 Online Courses: Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by respective Board of Studies.

4.4.3 Self Study Courses: The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the respective Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty. Self study course is limited to one per semester.

4.4.4 The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance (up to second semester).

4.4.5 A candidate can earn a maximum of 15 credits through all value added courses, online courses and self study courses.

4.5 Flexibility to Add or Drop Courses

4.5.1 A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.

4.5.2 From the second to fourth semesters the candidates have the option of registering for additional elective/Honors courses or dropping of already registered additional elective/Honors courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates. Total number of credits of such courses during the entire programme of study cannot exceed six.

4.6 Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.

4.7 The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.

4.8 The medium of instruction, examinations and project report shall be English.

5. DURATION OF THE PROGRAMME

5.1 A candidate is normally expected to complete the ME / MTech Degree programme in 4 consecutive semesters (2 Years), but in any case not more than 8 semesters (4 Years).

5.2 Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.



- 5.3** The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

6. COURSE REGISTRATION FOR THE EXAMINATION

- 6.1** Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.
- 6.2** The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8), earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.
- 6.3** If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.

7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

- 7.1** The ME/MTech programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Innovative Project, Internship cum Project work and Project Work. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:

Sl. No.	Category of Course	Continuous Assessment Marks	End Semester Examination
1.	Theory / Practical	50	50
2.	Theory cum Practical	The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components respectively.	
3.	Innovative Project/ Project Work / Internship cum Project Work	50	50
4.	Value Added Course	The distribution of marks shall be decided based on the credit the credit	---
5.	All other Courses		



	weightage assigned	
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- 7.2** Examiners for setting end semester examination question papers for theory courses, theory cum practical courses and practical courses and evaluating end semester examination answer scripts, project works, innovative project and internships shall be appointed by the Controller of Examinations after obtaining approval from the Principal.

7.3 Theory Courses

For all theory courses out of 100 marks, the continuous assessment shall be 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.

- 7.3.1** The assessment pattern for awarding continuous assessment marks shall be as follows:

Sl. No.	Type	Max. Marks	Remarks
1.	Test – I	30	Average of best two
	Test – II	30	
	Test - III	30	
2.	Tutorial	15	Should be of Open Book/Objective Type. Average of best 4 (or more, depending on the nature of the course, as may be approved by Principal)
3.	Assignment / Paper Presentation in Conference / Seminar / Comprehension / Activity based learning / Class notes	05	To be assessed by the Course Teacher based on any one type.
Total		50	Rounded off to the one decimal place

However, the assessment pattern for awarding the continuous assessment marks may be changed based on the nature of the course and is to be approved by the Principal.

- 7.3.2** A reassessment test or tutorial covering the respective test or tutorial portions



may be conducted for those candidates who were absent with valid reasons (Sports or any other reason approved by the Principal).

7.3.3 The end semester examination for theory courses shall be for duration of three hours.

7.4 Theory cum Practical Courses

For courses involving theory and practical components, the evaluation pattern as per the clause 7.1 shall be followed. Depending on the nature of the course, the end semester examination shall be conducted for theory and the practical components. The apportionment of continuous assessment and end semester examination marks shall be decided based on the credit weightage assigned to theory and practical components approved by Principal.

7.5 Practical Courses

For all practical courses out of 100 marks, the continuous assessment shall be for 50 marks and the end semester examination shall be for 50 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidate's records shall be maintained.

7.5.1 The assessment pattern for awarding continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course, and shall be based on rubrics for each experiment.

7.6 Project Work

7.6.1 Project work shall be carried out individually. Candidates can opt for full time internship (vide clause 7.8) in lieu of project work in third semester. The project work is mandatory for all the candidates.

7.6.2 The Head of the Department shall constitute review committee for project work. There shall be two assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.

7.6.3 The continuous assessment and end semester examination marks for Project Work and the Viva-Voce Examination shall be distributed as below.

Continuous Assessment (Max. 50 Marks)						End Semester Examination (Max. 50 Marks)			
Review I (Max..10 Marks)		Review II (Max.. 20 Marks)		Review III (Max. 20 Marks)		Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)		
Rv. Com	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Ext. Exr.	Guid e	Exr. 1	Exr. 2
5	5	10	10	10	10	20	10	10	10

7.6.4 The Project Report prepared according to approved guidelines and duly signed by the Guide and Project Co-ordinator shall be submitted to Head of the Department. A candidate must submit the project report within the specified date as per the academic schedule of the semester. If the project report is not



submitted within the specified date then the candidate is deemed to have failed in the Project Work and redo it in the subsequent semester. This applies to both Internship cum Project work and Project work.

- 7.6.5** If a candidate fails to secure 50% of the continuous assessment marks in the project work, he / she shall not be permitted to submit the report for that particular semester and shall have to redo it in the subsequent semester and satisfy attendance requirements.
- 7.6.6** Every candidate shall, based on his/her project work, publish a paper in a reputed journal or reputed conference in which full papers are published after usual review. A copy of the full paper accepted and proof for that shall be produced at the time of evaluation.
- 7.6.7** The project work shall be evaluated based on the project report submitted by the candidate in the respective semester and viva-voce examination by a committee consisting of two examiners and guide of the project work.
- 7.6.8** If a candidate fails to secure 50 % of the end semester examination marks in the project work, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted as per clause 7.6.7.
- 7.6.9** A copy of the approved project report after the successful completion of viva-voce examination shall be kept in the department library.

7.7 Innovative Project

The evaluation method shall be same as that of the Project Work as per clause 7.6 excluding clause 7.6.6.

7.8 Internship cum Project Work

Each candidate shall submit a brief report about the internship undergone and a certificate issued from the organization concerned at the time of Viva-voce examination to the review committee. The evaluation method shall be same as that of the Project Work as per clause 7.6 excluding 7.6.6.

7.9 Value Added Course

Two assessments shall be conducted during the value added course duration by the offering department concerned.

7.10 Online Course

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

7.11 Self Study Course

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.



7.12 Audit Course

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of Registration itself. Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SF (Satisfactory). Performance grade will not be shown for the audit course.

Since an audit course has no grade points assigned, it will not be counted for the purpose of GPA and CGPA calculations.

8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

8.1 A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.

8.1.1 Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (after rounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.

8.1.2 A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.

8.1.3 In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.

8.1.4 A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.

8.1.5 Candidate's progress is satisfactory.



8.1.6 Candidate's conduct is satisfactory and he/she was not involved in any indisciplined activities in the current semester.

8.2. The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.

8.3 The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester when it is offered next.

9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION

9.1 A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the higher semester.

9.2 When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.

9.3 A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.

10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS

10.1 A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.

10.2 The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.

10.3 The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.



- 10.4** If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.
- 10.5** The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

11. PROVISION FOR BREAK OF STUDY

- 11.1** A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination. A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.
- 11.2** The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.
- 11.3** The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 11.4** The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.
- 11.5** If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.
- 11.6** If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.



12. PASSING REQUIREMENTS

- 12.1** A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of 50 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.
- 12.2** A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.
- 12.3** For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements, but the grade awarded shall be only the lowest passing grade irrespective of the marks secured.

13. REVALUATION OF ANSWER SCRIPTS

A candidate shall apply for a photocopy of his / her semester examination answer script within a reasonable time from the declaration of results, on payment of a prescribed fee by submitting the proper application to the Controller of Examinations. The answer script shall be pursued and justified jointly by a faculty member who has handled the course and the course coordinator and recommended for revaluation. Based on the recommendation, the candidate can register for revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for revaluation and the results will be intimated to the candidate concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

14. SUPPLEMENTARY EXAMINATION

If a candidate fails to clear all courses in the final semester after the announcement of final end semester examination results, he/she shall be allowed to take up supplementary examinations to be conducted within a reasonable time for the courses of final semester alone, so that he/she gets a chance to complete the programme.

**15. AWARD OF LETTER GRADES**

Range of % of Total Marks	Letter Grade	Grade Point
91 to 100	O (Outstanding)	10
81 to 90	A+ (Excellent)	9
71 to 80	A (Very Good)	8
61 to 70	B+ (Good)	7
50 to 60	B (Average)	6
Less than 50	RA (Reappear)	0
Satisfactory	SF	0
Withdrawal	W	-
Absent	AB	-
Shortage of Attendance in a course	SA	-

The Grade Point Average (GPA) is calculated using the formula:

$$\text{GPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in the specific semester}}{\sum(\text{course credits}) \text{ for all courses in the specific semester}}$$

The Cumulative Grade Point Average (CGPA) is calculated from first semester (third semester for lateral entry candidates) to final semester using the formula

$$\text{CGPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in all the semesters so far}}{\sum(\text{course credits}) \text{ for all courses in all the semesters so far}}$$

The GPA and CGPA are computed only for the candidates with a pass in all the courses.

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester and at the end of successive semesters respectively.

A grade sheet for each semester shall be issued containing Grade obtained in each course, GPA and CGPA.

A duplicate copy, if required can be obtained on payment of a prescribed fee and satisfying other procedure requirements.

Withholding of Grades: The grades of a candidate may be withheld if he/she has not cleared his/her dues or if there is a disciplinary case pending against him/her or for any other reason.

16. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the ME / MTech Degree provided the candidate has

- Successfully completed all the courses under the different categories, as specified in the regulations.
- Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).



- iii. Successfully passed any additional courses prescribed by the respective Board of Studies whenever readmitted under regulations other than R-2020 (vide clause 11.3)
- iv. No disciplinary action pending against him / her.

17. CLASSIFICATION OF THE DEGREE AWARDED

17.1 First Class with Distinction:

17.1.1 A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the four semesters in the **First Appearance** within four consecutive semesters excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50

(OR)

17.1.2 A candidate who joins from other institutions on transfer or a candidate who gets readmitted and has to move from one regulation to another regulation and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the four semesters in the **First Appearance** within four consecutive semesters excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Submission of equivalent course list approved by the respective Board of studies.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 9.00

17.2 First Class:

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses of all four semesters within six consecutive semesters excluding authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 7.00



17.3 Second Class:

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

- 17.4** A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

18. MALPRACTICES IN TESTS AND EXAMINATIONS

If a candidate indulges in malpractice in any of the tests or end semester examinations, he/she shall be liable for punitive action as per the examination rules prescribed by the college from time to time.

19. AMENDMENTS

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the Kongu Engineering College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its ME / MTech programme.



CURRICULUM BREAKDOWN STRUCTURE						
Summary of Credit Distribution						
Category	Semester				Total number of credits	Curriculum Content (% of total number of credits of the program)
	I	II	III	IV		
FC	7	-	-	-	7	9.72
PC	13	14	-	-	27	37.50
PE	3	6	3	6	18	25.00
EC		2	9	9	20	27.78
Semester wise Total	22	23	12	15	72	100.00
Category						Abbreviation
Lecture hours per week						L
Tutorial hours per week						T
Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week						P
Credits						C

CATEGORISATION OF COURSES							
FOUNDATION COURSES (FC)							
S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	20AMT11	Applied Mathematics for Civil Engineers	3	1	0	4	1
2.	20GET11	Introduction to Research	2	1	0	3	1
Total Credits to be earned						7	
PROFESSIONAL CORE (PC)							
S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	20CMT11	Management Techniques in Construction	3	1	0	4	1
2.	20CMT12	Finance and Accounting for Management	3	1	0	4	1
3.	20CMT13	Advanced Construction Materials	3	0	0	3	1
4.	20CML11	Construction Management Laboratory I	0	0	2	1	1
5.	20CML12	Construction Engineering laboratory	0	0	2	1	1
6.	20CMT21	Construction Equipment And Machineries	3	0	0	3	2
7.	20CMT22	Construction Planning, Scheduling and Control	3	1	0	4	2



8.	20CMT23	Contract Laws and Regulations	3	0	0	3	2
9.	20CMT24	Quality Control and Assurance in Construction	3	0	0	3	2
10.	20CML21	Construction Management Laboratory II	0	0	2	1	2
Total Credits to be earned						27	
PROFESSIONAL ELECTIVE (PE)							
S. No.	Course Code	Course Name	L	T	P	C	Sem
		Elective 1					
1.	20CME01	Material Management	3	0	0	3	1
2.	20CME02	Construction Project Management	3	0	0	3	1
3.	20CME03	Management Information Systems	3	0	0	3	1
		Elective 2					
4.	20CME04	Infrastructure Management	3	0	0	3	2
5.	20CME05	Construction Project Control and Organization	3	0	0	3	2
6.	20CME06	Building Information Management	3	0	0	3	2
		Elective 3					
7.	20CME07	Real Estate Development and Design	3	0	0	3	2
8.	20CME08	GIS in Construction Engineering and Management	3	0	0	3	2
9.	20CME09	Construction Personnel Management	3	0	0	3	2
		Elective 4					
10.	20CME10	Shoring, Scaffolding and Formwork	3	0	0	3	3
11.	20CME11	System Integration in Construction	3	0	0	3	3
12.	20CME12	Resource Management and Control in Construction	3	0	0	3	3
		Elective 5					
13.	20CME13	IPR and Patenting	3	0	0	3	4
14.	20CME14	Project Safety Management	3	0	0	3	4
15.	20CME15	Building Information Modelling	3	0	0	3	4
		Elective 6					
16.	20CME16	Advanced Techniques For Construction	3	0	0	3	4
17.	20CME17	Maintenance and Rehabilitation of Structures	3	0	0	3	4
18.	20CME18	Green Building Management	3	0	0	3	4
19.	20GET13	Innovation, Entrepreneurship and Venture Development	3	0	0	3	4
Total Credits to be earned						18	



EMPLOYABILITY ENHANCEMENT COURSES (EC)							
S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	20CMP21	Innovative project	0	0	4	2	2
2.	20CMP31	Industrial Project / Internship	0	0	18	9	3
3.	20CMP41	Project Work	0	0	18	9	4
Total Credits to be earned						20	

**KEC R2020: SCHEDULING OF COURSES – ME (Construction Engineering and Management)**

Sem.	Theory/ Theory cum Practical / Practical								Internship & Projects	Credits
	1	2	3	4	5	6	7	8	8	
I	20AMT11– Applied Mathematics for Civil Engineers (BS 3-1-0-4)	20GET11– Introduction to Research (PC 3-0-0-3)	20CMT11– Management Techniques in Construction (PC 3-1-0-4)	20CMT12– Finance and Accounting for Management (PC 3-1-0-4)	20CMT13– Advanced Construction Materials (PC 3-0-0-3)	Professional Elective - I (PE 3-0-0-3)	20CML11 – Construction Management Laboratory - I (PC 0-0-2-1)	20CML12 – Construction Engineering Laboratory (PC 0-0-2-1)		23
II	20CMT21– Construction Equipment and Machineries (PC 3-0-0-3)	20CMT22– Construction Planning, Scheduling and Control (PC 3-1-0-4)	20CMT23– Contract Laws and Regulations (PC 3-0-0-3)	20CMT24– Quality Control and Assurance in Construction (PC 3-0-0-3)	Professional Elective - II (PE 3-0-0-3)	Professional Elective - III (PE 3-0-0-3)	20CML21 – Construction Management Laboratory- II (PC 0-0-2-1)		20CMP21 – Innovative Project (EC 0-0-4-2)	22
III	Professional Elective - IV (PE 3-0-0-3)								20CMP31 – Internship cum Project Work (EC 0-0-18-9)	12
IV	Professional Elective - V (PE 3-0-0-3)	Professional Elective - VI (PE 3-0-0-3)							20CMP41 – Project Work (EC 0-0-18-9)	15

Total Credits: 72



MAPPING OF COURSES WITH PROGRAM OUTCOMES							
Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5
1	20AMT11	Applied Mathematics for Civil Engineers	✓	✓			
1	20GET11	Introduction to Research	✓	✓	✓		
1	20CMT11	Management Techniques in Construction	✓		✓	✓	✓
1	20CMT12	Finance and Accounting for Management	✓		✓	✓	
1	20CMT13	Advanced Construction Materials	✓		✓		✓
1	20CML11	Construction Management Laboratory I	✓	✓	✓	✓	✓
1	20CML12	Construction Engineering laboratory	✓	✓	✓	✓	✓
2	20CMT21	Construction Equipment and Machineries	✓		✓		✓
2	20CMT22	Construction Planning, Scheduling and Control	✓		✓	✓	✓
2	20CMT23	Contract Laws and Regulations	✓	✓	✓		✓
2	20CMT24	Quality Control and Assurance in Construction	✓		✓		✓
2	20CML21	Construction Management Laboratory II	✓	✓	✓	✓	✓
2	20CMP21	Innovative Project	✓	✓	✓	✓	✓
3	20CMP31	Internship cum Project Work	✓	✓	✓	✓	✓
4	20CMP41	Project Work	✓	✓	✓	✓	✓



		Professional Elective Courses					
1	20CME01	Material Management	✓		✓	✓	✓
1	20CME02	Construction Project Management	✓		✓	✓	✓
1	20CME03	Management Information Systems	✓	✓	✓	✓	✓
2	20CME04	Infrastructure Management	✓		✓		✓
2	20CME05	Construction Project Control and Organization	✓	✓			✓
2	20CME06	Building Information Management	✓		✓	✓	
2	20CME07	Real Estate Development and Design	✓		✓		✓
2	20CME08	GIS in Construction Engineering and Management	✓		✓		✓
2	20CME09	Construction Personnel Management	✓		✓		✓
3	20CME10	Shoring, Scaffolding and Formwork	✓		✓		✓
3	20CME11	System Integration in Construction	✓		✓	✓	✓
3	20CME12	Resource Management and Control in Construction	✓		✓		✓
4	20CME13	IPR and Patenting	✓	✓	✓		✓
4	20CME14	Project Safety Management	✓		✓		✓
4	20CME15	Building Information Modelling	✓		✓	✓	✓
4	20CME16	Advanced Techniques For Construction	✓	✓	✓	✓	✓
4	20CME17	Maintenance and Rehabilitation of Structures	✓		✓		
4	20CME18	Green Building Management	✓	✓	✓		
4	20GET13	Innovation, Entrepreneurship and Venture Development	✓	✓	✓		

**M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT CURRICULUM-R2020**

SEMESTER – I									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
THEORY									
20AMT11	Applied Mathematics for Civil Engineers	3	1	0	4	50	50	100	FC
20GET11	Introduction to Research	2	1	0	3	50	50	100	FC
20CMT11	Management Techniques in Construction	3	1	0	4	50	50	100	PC
20CMT12	Finance and Accounting for Management	3	1	0	4	50	50	100	PC
20CMT13	Advanced Construction Materials	3	0	0	3	50	50	100	PC
	Professional Elective - I	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
20CML11	Construction Management Laboratory I	0	0	2	1	50	50	100	PC
20CML12	Construction Engineering laboratory	0	0	2	1	50	50	100	PC
Total Credits to be earned					23				

SEMESTER – II									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
THEORY									
20CMT21	Construction Equipment And Machineries	3	0	0	3	50	50	100	PC
20CMT22	Construction Planning, Scheduling and Control	3	1	0	4	50	50	100	PC
20CMT23	Contract Laws and Regulations	3	0	0	3	50	50	100	PC
20CMT24	Quality Control and Assurance in Construction	3	0	0	3	50	50	100	PC
	Professional Elective - II	3	0	0	3	50	50	100	PE
	Professional Elective - III	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
20CML21	Construction Management Laboratory II	0	0	2	1	50	50	100	PC
20CMP21	Innovative Project	0	0	4	2	50	50	100	EC
Total Credits to be earned					22				

SEMESTER – III					
Course	Course Title	Hours / Week		Credit	Maximum Marks



Code		L	T	P		CA	ESE	Total	Category
Practical / Employability Enhancement									
	Professional Elective IV	3	0	0	3	50	50	100	PE
20CMP31	Internship cum Project Work	0	0	18	9	50	50	100	EC
Total Credits to be earned					12				

SEMESTER – IV									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
THEORY/THEORY WITH PRACTICAL									
	Professional Elective-V	3	0	0	3	50	50	100	PE
	Professional Elective-VI	3	0	0	3	50	50	100	PE
PRACTICAL									
20CMP41	Project Work	0	0	18	9	50	50	100	EC
Total Credits to be earned					15				

Total Credits: 72



LIST OF PROFESSIONAL ELECTIVES						
Course Code	Course Title	Hours/Week			Credit	CBS
		L	T	P		
Semester I						
Elective I						
20CME01	Material Management	3	0	0	3	PE
20CME02	Construction Project Management	3	0	0	3	PE
20CME03	Management Information Systems	3	0	0	3	PE
Semester II						
Elective II						
20CME04	Infrastructure Management	3	0	0	3	PE
20CME05	Construction Project Control and Organization	3	0	0	3	PE
20CME06	Building Information Management	3	0	0	3	PE
Elective III						
20CME07	Real Estate Development and Design	3	0	0	3	PE
20CME08	GIS in Construction Engineering and Management	3	0	0	3	PE
20CME09	Construction Personnel Management	3	0	0	3	PE
Semester III						
Elective IV						
20CME10	Shoring, Scaffolding and Formwork	3	0	0	3	PE
20CME11	System Integration in Construction	3	0	0	3	PE
20CME12	Resource Management and Control in Construction	3	0	0	3	PE
Semester IV						
Elective V						
20CME13	IPR and Patenting	3	0	0	3	PE
20CME14	Project Safety Management	3	0	0	3	PE
20CME15	Building Information Modelling	3	0	0	3	PE
Elective VI						
20CME16	Advanced Techniques For Construction	3	0	0	3	PE
20CME17	Maintenance and Rehabilitation of Structures	3	0	0	3	PE
20CME18	Green Building Management	3	0	0	3	PE
20GET13	Innovation, Entrepreneurship and Venture Development	3	0	0	3	PE



20AMT11 APPLIED MATHEMATICS FOR CIVIL ENGINEERS
(Common to Construction Engineering & Management and Structural Engineering)

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	FC	3	1	0	4

Preamble	This course is designed to provide the solid foundation on topics in various statistical methods such as correlation and regression, principles of estimation theory and multivariate analysis which form the basis for modeling construction engineering problems and also provides a broad spectrum of mathematical techniques such as calculus of variations and tensor analysis which has wide applications in structures.	
Unit - I	Correlation and Regression:	9+3
Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order co-efficient.		
Unit - II	Parameter Estimation:	9+3
Point Estimation – Characteristics of estimators – Unbiasedness – Consistency – Efficiency – Sufficiency – Methods of point estimation – Method of moments –Method of Maximum likelihood.		
Unit - III	Multivariate Analysis:	9+3
Random vectors and Matrices – Mean vectors and Covariance matrices – Multivariate Normal density and its properties – Principal components: Population principal components – Principal components from standardized variables.		
Unit - IV	Calculus of Variations:	9+3
Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems – Direct methods – Ritz and Kantorovich methods.		
Unit - V	Tensor Analysis:	9+3
Summation convention – Contravariant and covariant vectors – Contraction of tensors – Arithmetic operations on tensors – Inner product – Metric tensor – Christoffel symbols – Covariant differentiation – Gradient - Divergence and curl.		

Lecture:45, Tutorial:15, Total:60

REFERENCES:

1.	Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Thomson Asia, 2002.
2.	Gupta S.C. and Kapoor V.K. "Fundamentals of Mathematical Statistics" Sultan Chand and Sons, 11 th Edition 2002.
3.	Johnson, R.A. and Wichern, D. W. "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 6 th Edition, 2007
4.	Elsgolc, L.D., "Calculus of Variations", Dover Publications Inc., New York, 2007.
5.	Kay, D. C., "Tensor Calculus", Schaum's Outline Series, Tata McGraw Hill Edition, 2014.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

CO1	measure the relationship between variables that exists in civil engineering problems.	Applying (K3)
CO2	use a sample data to compute point estimate.	Applying (K3)
CO3	perform exploratory analysis of multivariate data.	Applying (K3)
CO4	solve problems involving functional that occurs in various branches of engineering disciplines.	Applying (K3)
CO5	identify various tensors that occur in engineering problems.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2			
CO2	2	2			
CO3	3	2			
CO4	3	2			
CO5	3	2			

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
CAT3	10	20	70	-	-	-	100
ESE	10	20	70	-	-	-	100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20GET11 INTRODUCTION TO RESEARCH**

(Common to all ME / MTech Engineering and Technology Branches)

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	2	1	0	3

Preamble	This course will familiarize the fundamental concepts/techniques adopted in research, problem formulation and patenting. Also will disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools.	
Unit - I	Concept of Research:	6+3
Meaning and Significance of Research: Skills, Habits and Attitudes for Research - Time Management - Status of Research in India. Why, How and What a Research is? - Types and Process of Research - Outcome of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords - Literature Collection – Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques.		
Unit - II	Research Methods and Journals:	6+3
Interdisciplinary Research - Need for Experimental Investigations - Data Collection Methods - Appropriate Choice of Algorithms / Methodologies / Methods - Measurement and Result Analysis - Investigation of Solutions for Research Problem - Interpretation - Research Limitations. Journals in Science/Engineering - Indexing and Impact factor of Journals - Citations - h Index - i10 Index - Journal Policies - How to Read a Published Paper - Ethical issues Related to Publishing - Plagiarism and Self-Plagiarism.		
Unit - III	Paper Writing and Research Tools:	6+3
Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study - When and Where to Publish? - Journal Selection Methods. Layout of a Research Paper - Guidelines for Submitting the Research Paper - Review Process - Addressing Reviewer Comments. Use of tools / Techniques for Research - Hands on Training related to Reference Management Software - EndNote, Software for Paper Formatting like LaTeX/MS Office. Introduction to Origin, SPSS, ANOVA etc., Software for detection of Plagiarism.		
Unit - IV	Effective Technical Thesis Writing/Presentation:	6+3
How to Write a Report - Language and Style - Format of Project Report - Use of Quotations - Method of Transcription Special Elements: Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc. - Different Reference Formats. Presentation using PPTs.		
Unit - V	Nature of Intellectual Property:	6+3
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.		

Lecture: 30, Tutorial:15, Total:45**REFERENCES:**

1.	DePoy, Elizabeth, and Laura N. Gitlin, "Introduction to Research-E-Book: Understanding and Applying Multiple Strategies", Elsevier Health Sciences, 2015.
2.	Walliman, Nicholas, "Research Methods: The basics", Routledge, 2017.
3.	Bettig Ronald V., "Copyrighting culture: The political economy of intellectual property", Routledge, 2018.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1:	list the various stages in research and categorize the quality of journals.	Analyzing (K4)
CO2:	formulate a research problem from published literature/journal papers	Evaluating (K5)
CO3:	write, present a journal paper/ project report in proper format	Creating (K6)
CO4:	select suitable journal and submit a research paper.	Applying (K3)
CO5:	compile a research report and the presentation	Applying (K3)

Mapping of COs with POs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1		
CO2	3	2	3		
CO3	3	3	1		
CO4	3	2	1		
CO5	3	2	1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		30	40	30			100
CAT2		30	40	30			100
CAT3			30	40	30		100
ESE		30	40	30			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20CMT11– MANAGEMENT TECHNIQUES IN CONSTRUCTION**

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	3	1	0	4

Preamble	To give knowledge of various scientific methods to help students in taking right decisions for various aspects of construction projects.	
Unit - I	Operation Research:	9+3
Introduction to Operation Research - Structure of Mathematical Model - Limitations of Operation Research - Linear-Programming Problem - Requirements of LPP - Mathematical Formulation of LPP - Graphical Method - Simplex Method Penalty Cost Method.		
Unit - II	Optimality Analysis:	9+3
Duality and Post - Optimality Analysis - Transportation Problem - Finding Basic Feasible Solution - Northwest Corner Rule - Least Cost Method - Vogel's Approximation Method - Optimality Test - The Stepping Stone Method - MODI Method - Assignment Problem.		
Unit - III	Simulation:	9+3
Introduction - Methodology of Simulation - Basic Concepts - Simulation Procedure - Monte-Carlo Simulation- Applications of Simulation - Advantages of Simulation- Limitations of Simulation.		
Unit - IV	Decision Theory:	9+3
Decision Theory - Decision Rules - Decision making under conditions of certainty, risk and uncertainty - Decision trees - Utility Theory - Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications.		
Unit - V	Inventory Models:	9+3
Deterministic and Probabilistic Inventory Models - ABC Analysis - XYZ Analysis - VED Analysis - Safety Stock - Quantity Discounts - Software Applications.		

Lecture:45, Tutorial:15, Total:60**REFERENCES:**

1.	Vohra N.D., "Quantitative Techniques in Management", 3 rd Edition, Tata McGraw-Hill Company Ltd., New Delhi, 2006.
2.	Sehroeder R.G., "Operations Management", 7 th Edition, McGraw-Hill, New York, 2017.
3.	Taha H.A., "Operations Research - An Introduction", 8 th Edition, Prentice Hall, 2011.

COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1	solve linear problems through various methods of OR	Applying (K3)
CO2	determine the optimal solution for transportation and assignment problems	Applying (K3)



CO3	summarize the basic concepts of simulation	Understanding (K2)
CO4	recognize the need of decision making	Understanding (K2)
CO5	differentiate the types of inventory models for the project	Understanding (K2)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		2		2
CO2	3		2		2
CO3	2		3		2
CO4	2		3		2
CO5	2		3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	7	33	60				100
CAT2	7	46	47				100
CAT3	10	33	57				100
ESE	7	43	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	3	1	0	4

Preamble	To make the students to understand the cash flow technique and accounting concepts of management	
Unit - I	Financial Aspects:	9+3
Financing of projects - Means of finance - Equity and Debt - Financial institutions - Cost of Capital - Risk Analysis, Sources, Measures and Methods of risk analysis.		
Unit - II	Time Value of Money:	9+3
Time Value of Money - Time lines and Notations - Future and Present value of single amount - Future and Present value of an annuity - Simple interest - Compound interest - Project cash Flows - Principles of cash flow estimation.		
Unit - III	Costing:	9+3
Investment Criteria - Discounting criteria -Net present value (NPV), Benefit Cost Ratio (BCR), Internal Rate of Return(IRR) - Non-Discounting criteria - Pay Back Period, Urgency - Accounting Rate of Return(ARR) - Indian Practice of Investment Appraisal - International Practice of Appraisal.		
Unit - IV	Accounting Concepts and Standards:	9+3
Accounting Concepts - Principles - Policies and Standards -Types of accounting concepts - Accounting Standards - Scope and functions of Accounting Standards Board - International Financial Reporting System.		
Unit - V	Management Accounting and Budgetary Control:	9+3
Management accounting - Concept, Need, Importance and Scope - Working Capital Management - Cost Concepts -Break Even Analysis - Pricing Techniques.		

Lecture:45, Tutorial:15, Total:60**REFERENCES:**

1.	Prasanna Chandra, "Projects -Planning Analysis Selection Implementation and Review", 21 st Edition, Tata McGraw Hill, New Delhi, 2014.
2.	Joy P.K., "Total Project Management - The Indian Context (Chapters 37)", 2 nd Edition, Macmillan India Ltd., New Delhi, 2002.
3.	Barcus S.W. and Wilkinson J.V., "Hand Book of Management Consulting Services", 2 nd Edition McGraw Hill Education, New York, 1994.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	evaluate the risk involved in costing and financial aspects of projects	Applying (K3)
CO2	illustrate the basics of Time value of money	Applying (K3)
CO3	categorize the various investment criteria for project	Understanding (K2)
CO4	acquire distinct knowledge about financial accounting standards	Understanding (K2)
CO5	summarize the importance of accounting and management concepts.	Understanding (K2)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		2	2	
CO2	3		2	2	
CO3	2		3	2	
CO4	2		2	3	
CO5	3		2	2	
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	35	45				100
CAT3	15	40	45				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	3	0	0	3

Preamble	To identify advanced construction materials available in the market to perform a construction activity										
Unit - I	Special Concrete Materials:										9
Translucent Concrete- SensiTile- Electrified Wood- Self-Repairing Cement- Self-Repairing Concrete- Carbon Fiber- Bendable Concrete- Concrete Canvas- Low-E Glass / Films- Condensed Silica Fume- Ternary Blends- Photo catalytic Cement- Advanced Composite Reinforcement- Nano Materials and its application.											
Unit - II	Metals and Alloy:										9
Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel, Corrosion of concrete in various environments - Corrosion of reinforcing steel - Methods/treatments to overcome corrosion - Electro-chemical process - Ferro-cement - Fibers and composites - Composites and its applications											
Unit - III	Ceramic Materials:										9
Classification - Refractory glass - mechanical, thermal and electrical properties - Fire resistant material - Uses and application - New types of floor finishes and tiling - Liquid granite - Lotuslan in paints.											
Unit - IV	Advanced Materials:										9
Adhesives and sealants in construction industry -Acrylics, Bridge bearings - Industrial wastes in concrete - Rapid wall panels - Moisture Barriers.											
Unit - V	Planning for Earthwork Construction:										9
Planning, Graphical Presentation of Earthwork, Earthwork Quantities, Mass Diagram, Pricing Earthwork Operations.											

Lecture: 45, Total: 45**REFERENCES:**

1.	Adam M Neville, "Properties of Concrete", 5 th Edition, Longman Sc and Tech Publishers, 2011.
2.	Kumar Mehta P. and Paulo J.M. Monteiro, "Concrete Microstructure, Properties and Materials", McGraw Hill, 2006.
3.	Verghese P.C., "Building Material", PHI EEE, New Delhi, 2012.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	Identify the structural and physical applications of advanced materials used in concrete.	Understanding (K2)
CO2	Classify the types of metals and alloys used for construction.	Understanding (K2)
CO3	Sort out the various properties of non structural elements in construction	Understanding (K2)
CO4	Interpret the usage of adhesives and sealants in buildings	Understanding (K2)
CO5	plan and allocate suitable materials for earthwork	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		2
CO3	2		2		3
CO4	2		3		2
CO5	2		3		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	50	50					100
CAT3	50	50					100
ESE	50	50					100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	0	0	2	1
Preamble	To derive quantities, schedule and allocate resources for construction projects using the management tools.						

List of Exercises / Experiments :

1.	Quantity takeoff and Preparation of bid for construction project
2.	Usage of MS Project & PRIMAVERA with CPM & PERT
3.	Estimation of a single storey building.
4.	Scheduling of construction project using MS project (Scheduling includes report and tracking)
5.	Scheduling and allocation of resources.
6.	Scheduling of construction project using Primavera (Scheduling includes report and tracking)
7.	Resource leveling, resource list and Resource loading
8.	Deterministic and Probabilistic Inventory Models - Software applications
9.	Decision Making – Baye's Theory

Practical : 30, Total: 30**REFERENCES/MANUAL/SOFTWARE:**

1.	Carl S Chattfield and Timothy D Johnson, "Microsoft Project 2016 Step by Step", 1 st Edition, Pearson Publication, 2016.
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COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1	apply computational techniques in optimization and sequencing problems	Applying (K3), Manipulation (S2)
CO2	schedule using management tools	Applying (K3), Manipulation (S2)
CO3	allocate resources for construction projects	Applying (K3), Manipulation (S2)
CO4	quantify the volume of activities involved in a project	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	2	3	2	2	3
CO3	2	2	2	2	3
CO4	2	2	2	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	0	0	2	1
Preamble	To determine various construction material properties						

List of Exercises / Experiments :

1.	Determination of Specific Gravity of Cement and Mineral Admixtures using Le- Chatlier Flask.
2.	Draw Stress Strain curve for Ductile and Brittle material in tension.
3.	Draw Stress Strain curve for Ductile and Brittle material in compression.
4.	Determination of Water Quality (Chloride, Sulphate, pH and Hardness Tests).
5.	Determination of CBR Value.
6.	Determination of Setting Time of Concrete using Penetration Test.
7.	Determination of Workability of Concrete by Flow Table Test and Vee-Bee Consistometer Tests.
8.	Determination of Flow ability Tests of Self Compacting Concrete.
9.	Determination of Modulus of Elasticity of Concrete using Deflectometer.
10.	Mortar bar expansion test.
11.	Determination Flexural Strength of Concrete Beam using Two Point Loading Method.
12.	Determination of Concrete Quality using Non-Destructive Tests using USPV and Rebound Hammer.

Practical : 30, Total: 30**REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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COURSE OUTCOMES:

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	Estimate the properties of fresh and hardened concrete	Applying (K3), Manipulation (S2)
CO2	Sketch the behaviour of materials under compression and tension	Applying (K3), Manipulation (S2)
CO3	Interpret the quality standards of water and subgrade	Applying (K3), Manipulation (S2)
CO4	quantify the concrete quality through NDT	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	2	3	2	2	3
CO3	2	2	2	2	3
CO4	2	2	2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PC	3	0	0	3

Preamble	To impart knowledge in the selection strategies of various equipment based on the requirements of project at optimum cost and time.	
Unit - I	Equipment Management:	9
Identification – Factors in Selection of Equipment - Planning Equipment Utilization – Renting Strategies – Capital cost – Investment Alternatives – Elements of Operating and Owning – Bidding Costs – Replacement Decisions – Rent and Lease Considerations.		
Unit - II	Earthwork Equipment:	9
Tractors - Motor Graders - Scrapers - Front end Loaders - Earth Movers - Equipment for Dredging and Trenching - Tunneling methods and equipments - Compaction Equipment - Diaphragm wall equipment - Pile Driving Equipment - Drilling and Blasting - Safety measures.		
Unit - III	Equipments for Screening and Transporting:	9
Forklifts and related equipment - Portable Material Bins - Tower crane - Conveyors - Aggregate Crushers - Feeders - Screening Equipment - General Crane - Gantry girder.		
Unit - IV	Concreting Equipment:	9
Batching and Mixing Equipment - Hauling equipment - RMC - Modern Formwork Techniques - MIVAN Construction - Shuttering - Types of pumps used for Construction - Boom placer - Equipment for Grouting and Dewatering - 3D Concrete Printing.		
Unit - V	Surveying Equipment:	9
Modern electronic surveying equipments - Digital levels - Digital theodolite - Advance Total station - Lasers and sensors in Surveying - Remote sensing - Geographical Information System		

Lecture: 45, Total: 45**REFERENCES:**

1.	Deodhar S.V., "Construction Equipment and Job Planning", 1 st Edition, Khanna Publishers, New Delhi, 1988.
2.	Peurifoy R.L., "Construction Planning, Equipment and Methods", 7 th Edition, McGraw Hill, Singapore, 2013.
3.	Sharma S.C., "Construction Equipment and Management", 5 th Edition, Khanna Publishers, New Delhi, 2007.
4.	Leonid Nadolinets, "Surveying Instruments and Technology", 1 st Edition, CRC Press, 2017.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	analyse the cost of performing equipment	Applying (K3)
CO2	identify the various equipment's used for earth work	Understanding (K2)
CO3	recommend equipment for screening and transporting in construction	Understanding (K2)
CO4	interpret a suitable equipment for concreting works	Understanding (K2)
CO5	select a suitable equipment to perform surveying	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		3		2
CO2	2		3		2
CO3	3		2		2
CO4	2		2		3
CO5	2		3		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	20	80					100
CAT3	20	80					100
ESE	20	60	20				100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PC	3	1	0	4

Preamble	To learn management tools and techniques for planning, scheduling, organizing, controlling and monitoring of construction projects.	
Unit - I	Construction Planning:	9+3
Introduction to Construction Projects - Project Categories - Project Participants - Project Life Cycle – Planning – Role of Planning Department in Construction- objectives – principles - stages of planning –Defining work task and precedence relationships among activities- Estimating durations and resources requirements- Coding system		
Unit - II	Project Scheduling:	9+3
Construction scheduling - Work Breakdown Structure - Project Cost and Time Estimation - Bar Chart - Milestone Chart - CPM - PERT - RPM - LOB - Software's in construction scheduling - Primavera - MSP.		
Unit - III	Scheduling with Resource Constraints:	9+3
Scheduling with Resource Constraints and Precedence – Use of Advanced Scheduling Techniques – Scheduling with Uncertain Durations – Calculations for Monte Carlo Schedule Simulation – Crashing and Time/Cost Tradeoffs – Improving the Scheduling Process.		
Unit - IV	Cost Control:	9+3
Monitoring and control of construction projects – quality control- importance-objectives – methods - cost control –objectives – control systems – direct and indirect cost control – project budgetary control – Project risk analysis and mitigation.		
Unit - V	Organizing and Use of Project Information:	9+3
Types of project information- accuracy – use of information – computerized information – uses – database – database models- relational model- centralized model- applications.		

Lecture:45, Tutorial:15, Total:60**REFERENCES:**

1.	Dr. Seetharaman S., "Construction Engineering and Management", 2 nd Edition, Umesh Publications, 2000.
2.	Chitkara K.K., "Construction Project Management Planning Scheduling and Controlling", 18 th Reprint, Tata McGraw Hill, 2009.
3.	Sengupta and Guha, "Construction Management and Planning", 1 st Edition, Tata McGraw Hill Publication, 2015.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize the importance of planning	Understanding (K2)
CO2	determine the project time and cost	Applying (K3)
CO3	evaluate time – cost trade offs	Evaluating (K5)
CO4	recognize the need of project control	Understanding (K2)
CO5	Illustrate the database models and its applications in construction projects	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		2
CO2	2		2	3	2
CO3	2		3	3	2
CO4	2		3		2
CO5	2		3	3	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	11	66	23				100
CAT2	7	20	33	7	33		100
CAT3	7	66	27				100
ESE	7	43	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PC	3	0	0	3

Preamble	Create awareness on contracts for construction industry, impart knowledge on tender preparation, tendering process, arbitration procedure and laws, Legal requirements and Labour Regulations.	
Unit - I	Construction Contracts:	9
Indian Contract Act - Elements of contracts - Types of contracts - Features - Suitability - Design of contract documents - International contract document (FIDIC, etc) - Standard contract document - Contractual claims - Law of Torts.		
Unit - II	Tenders:	9
Project cost estimation - Rate analysis - Overhead charges - Bidding models and bidding strategies - Owner's and contractor's estimate - Prequalification - Bidding - Accepting - Evaluation of tender - World Bank procedures and guidelines - Tamilnadu Transparency in Tenders Act.		
Unit - III	Arbitration:	9
Arbitration Act - UNCITRAL model law - Forms of arbitration - Arbitration agreement - Appointment of arbitrators - Conditions of arbitration - Powers and duties of arbitrator - Enforcement of award - Costs - Duties and responsibilities of parties		
Unit - IV	Legal Requirements:	9
Insurance and bonding - Laws Governing Sale, Purchase and use of urban and rural land – Land revenue codes – Tax Laws – Income Tax, GST, Excise and Custom Duties and their influence on construction costs.		
Unit - V	Labour Regulations:	9
Social security – Welfare legislation – Laws relating to wages, bonus and industrial disputes, labour administration – Insurance and safety regulations – Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labor Act - Other Labor Laws.		

Lecture: 45, Total: 45**REFERENCES:**

1.	Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", 4 th Edition, M.M.Tripathi Pvt. Ltd., Bombay, 2000.
2.	Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects", 7 th Edition, McGraw-Hill, New York, 2010.
3.	Jimmie Hinze, "Construction Contracts", 2 nd Edition, McGraw-Hill, New York, 2001.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	draft a contract document with all necessary elements	Applying (K3)
CO2	prepare a tender and contract as per legal requirement	Applying (K3)
CO3	suggest suitable type of arbitration and resolving disputes between parties	Applying (K3)
CO4	examine the laws and taxes influencing construction costs	Applying (K3)
CO5	solve disputes by implementing labour regulations in construction projects	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		2		3
CO2	3	2	3		3
CO3	3		3		3
CO4	3		3		3
CO5	3		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PC	3	0	0	3

Preamble	To classify the organization, do quality planning and implement the techniques needed for QA/QC programme	
Unit - I	Construction Organization:	9
Types of organization - Inspection - Quality Management Systems and method - Responsibilities and authorities in quality assurance and quality control - Quality circle.		
Unit - II	Quality Planning:	9
Quality Policy - Objectives and methods in Construction Industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance - Taguchi's concept of quality - Document - Contract and construction programming - Inspection procedures - Processes and products - Total QA / QC programme and cost implication.		
Unit - III	Quality Assurance:	9
Objectives - Regularity agent, owner, design, contract and construction oriented objectives, methods - Techniques and needs of QA/QC - Different aspects of quality.		
Unit - IV	Factors of Construction Quality:	9
Appraisals - Critical, Major Failure Aspects and Failure Mode Analysis - Stability methods and tools, optimum design - Reliability testing, reliability coefficient and reliability prediction.		
Unit - V	Quality Control:	9
Quality Control by statistical methods – Sampling by attributes and variables - Bid preparation - Construction activity, environmental safety, social and environmental factors - Natural causes and speed of construction - Life cycle costing -Value engineering and value analysis.		

Lecture: 45, Total: 45

REFERENCES:

1.	Charles S. Tapiero, "The Management of Quality and its Control", 3 rd Edition, Springer Science Edition, 2016.
2.	Amitava Mitra, "Fundamentals of Quality Control and Improvement", 1 st Edition, Wiley Edition, 2016.
3.	O'Brian James J., "Construction Inspection Handbook - Quality Assurance and Quality Control", 2 nd Edition, Van Nostrand, New York, 1989.



On completion of the course, the students will be able to		(Highest Level)
CO1	classify the types of organisation and quality management methods	Understanding (K2)
CO2	implement the techniques for consumers satisfaction and quality inspection	Applying (K3)
CO3	interpret the methods and techniques of QA/QC	Applying (K3)
CO4	describe major failure aspects and implement FMEA for construction projects	Understanding (K2)
CO5	apply quality principles in construction along with value engineering practices	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1			2		3
CO2	1		3		1
CO3	2		3		3
CO4	1		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	15	25	60				100
CAT3	20	30	50				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Management Tools For Construction Engineers I	2	PC	0	0	2	1
Preamble	To estimate and model the construction projects using advanced management tools and techniques						

List of Exercises / Experiments :

1.	Usage of Management tools for construction Projects
2.	Comparison of MS Project & PRIMAVERA with various WBS
3.	Estimation of a multi storey building.
4.	Modelling of project using Revit Architecture
5.	Modelling using BIM
6.	Determination of RI value using SPSS
7.	SPSS for single and multiple objective function
8.	Introduction to other advanced management software

Practical : 30, Total: 30**REFERENCES/MANUAL/SOFTWARE:**

1.	Daniel L. Williams, Elaine Britt Krazer, "Oracle Primavera P6 Version 8: Project and Portfolio Management", 1 st Edition, Packt Publishing Ltd., 2012.
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COURSE OUTCOMES:

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	apply advanced management tools	Applying (K3), Manipulation (S2)
CO2	model the building using BIM and Revit Architecture	Creating (K6), Manipulation (S2)
CO3	determine the ranking values using SPSS	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2	3	3
CO2	2		2	3	2
CO3	2		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	EC	0	0	4	2

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	2	2
CO5	3	3	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	EC	0	0	18	9

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	EC	0	0	18	9

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PE	3	0	0	3

Preamble	To identify, define and comprehend the effective purchase, utilization and storage of materials.	
Unit - I	Introduction:	9
Importance of material management - Material Requirement Planning- Role of Material Management in construction industry - Scope, Objectives and Functions - Integrated approach to materials management - Role of material manager.		
Unit - II	Classification and Codification of Materials of Construction:	9
ABC, FSN, VED, SOS,XYZ analysis - Procedure and its use - Standardization in materials and their management - Procurement - Identification of sources of procurement- Vendor analysis - Purchase procedure - Legal aspects.		
Unit - III	Inventory Management:	9
Store Purchase Manual - Inventory Control techniques. EOQ - Advantages and limitation of use of EOQ, Reorder Point - Safety stock and stock out cost - Concept of (JIT) - Just in time management- Indices used for assessment of effectiveness of inventory management.		
Unit - IV	Stores Management and Quality Control:	9
Receipt and inspection - Care and safety in handling - losses and wastage on storage - Bulk purchasing - scheduling of resources - Conventional methods of maintaining quality in Construction - Statistical method of quality control - Quality management and its economics		
Unit - V	Project Evaluation and Procurement:	9
Materials Management Systems - Procurement of Materials - Cost control - Discounted Cash Flow - Real Options Theory - Project delivery methods - Integrated project delivery - Competitive bidding and Contract negotiation.		

Lecture: 45, Total: 45

REFERENCES:

1.	"A Guide to the Project Management Body of Knowledge (PMBOK Guide)", 4 th Edition, An American National Standard, ANSI/PMI 990001-2008.
2.	Chitale A.K. and Gupta R.C., "Material Management – Text and Cases", 3 rd Edition, Prentice Hall of India Pvt. Ltd., 2014.
3.	Joseph Philips, "Project Management and Professional (Certification Study Guides)", 4 th Edition, McGraw Hill Publication, 2013.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the need and role of material management and manager	Understanding (K2)
CO2	classify materials and identify the sources of procuring materials	Applying (K3)
CO3	exercise control over effective management of maintaining inventory	Applying (K3)
CO4	manage stores and exercise quality control on materials	Applying (K3)
CO5	apply MMS in planning to manage risk and evaluate construction projects effectively.	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		3		2
CO2	3		3		3
CO3	3		3		2
CO4	3		3		2
CO5	3		3	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	12	18	70				100
CAT2	15	25	60				100
CAT3	20	30	50				100
ESE	20	20	60				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

20CME02– CONSTRUCTION PROJECT MANAGEMENT

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
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Prerequisites	Nil	1	PE	3	0	0	3
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Preamble	To enrich the concepts related to Project management and Resources Utilization	
Unit - I	Introduction to Project:	9
Concept of a Project – Characteristic features – Project Life cycle – Phases – Project Management – Tools and techniques for project management – Role of project managers.		
Unit - II	Role of Project Management:	9
Development of project plan and objectives – Leadership and Motivation -Interpersonal Behaviour in Project Organizations – Organization and project team –Communication in project management.		
Unit - III	Working Systems:	9
Design and Construction Process - Design and Construction as an Integrated System – Work breakdown system (WBS) – Project execution plan –Sub systems of project management- Monitoring of projects -Monitoring of contracts.		
Unit - IV	Project Direction:	9
Project direction – Direction during production stage – Value engineering review – Stages –Directives – Project coordination – Procedure – Interface management – Project control –Scope for progress control – Overall project progress control – Stages – Methods.		
Unit - V	Resource Management:	9
Basic concept – Labor requirements – Labor productivity – Site productivity – Equipment Management – Material management- Procurement organization – Procurement planning – Functions of material management –Analysis of Inventory control		

Lecture: 45, Total: 45

REFERENCES:

1.	Prasanna Chandra, "Project Planning, Analysis, Selection, Implementation and Review", 21 st Edition, Tata McGraw Hill, New Delhi, 2014.
2.	Chitkara K.K., "Construction Project Management: Planning Scheduling and Control", 18 th Edition, Tata McGraw-Hill, New Delhi, 2009.
3.	Choudhury S., "Project Management", 31 st Edition, Tata McGraw-Hill, New Delhi, 2008.

COURSE OUTCOMES:

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**



CO1	identify the owners view on a project in consideration with entire life cycle of project.	Understanding (K2)
CO2	Relate the various types of organization and their impact in construction projects	Applying (K3)
CO3	infer various concepts of working systems in construction process	Understanding (K2)
CO4	develop a good relation between project direction and value engineering	Understanding (K2)
CO5	evaluate the resource requirement needed for construction project	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2	3	2
CO2	2		3	2	2
CO3	3		2	2	2
CO4	2		2	3	2
CO5	2		2	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	40	35				100
CAT2	25	35	40				100
CAT3	20	40	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PE	3	0	0	3

Preamble	To impart knowledge on the role of Information Systems and development of system models for providing support systems to the industry	
Unit - I	Introduction to Information System:	9
Introduction to Information System: System Concepts - Trends - Types of Information System - Operations Support Systems - Transaction processing systems - Management information systems - Management Support Systems - Strategic Information system and other classifications - Success and Failure with IT.		
Unit - II	Strategic uses of Information Technology:	9
Business level Strategy - Firm level Strategy - Role of IT in Re-engineering – Functional Business Systems – Marketing – Manufacturing – Human Resource – Accounting – Financial Management Systems.		
Unit - III	Enterprise System:	9
Business Process Integration with IT - Challenges of Enterprise Systems - International Information Systems - Outsourcing and off-shoring - Supply Chain Management - Customer Relationship Management Enterprise Resource Planning - E-commerce Business Models - Electronic Payment Systems - Electronic Data Interchange (EDI).		
Unit - IV	Support Systems:	9
Decision Support Systems: Group decision support system – What if Analysis – Sensitivity Analysis – Goal seeking Analysis – Optimization Analysis - Knowledge management system - Artificial Intelligence Technologies in Business - Expert Systems		
Unit - V	Developing Business System and Security:	9
System Development Life Cycle – Approaches: Water Flow – Prototype – Spiral – RAD – Incremental – System Analysis – System Design Tools: Data Flow Diagram – System Implementation – Software Assurance Testing – Data Quality Audits – Ethical Analysis.		

Lecture: 45, Total: 45**REFERENCES:**

1.	James A.O'Brien, "Management Information systems", 10 th Edition, McGraw-Hill Pvt Limited, , 2017.
2.	Kenneth .C.Laudon, "Management Information Systems – Managing the digital firm", Pearson Education, 15 th Edition, 2017.
3.	Oz Effy, "Management Information Systems", Cengage Learning India Pvt. Ltd, 6 th Edition, 2013.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the role of information systems in an organization	Understanding (K2)
CO2	Brief on strategic management process and implications of it.	Understanding (K2)
CO3	Acquire knowledge about enterprise systems and the role of internet	Understanding (K2)
CO4	Get acquainted with the support systems for implementing information systems	Understanding (K2)
CO5	Develop software model and to know ethical and social issues of IS	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2		3
CO2	2	2	2		3
CO3			3		3
CO4	2		2		3
CO5	2		2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	34	66					100
CAT2	50	50					100
CAT3	20	40	40				100
ESE	30	40	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PE	3	0	0	3

Preamble	To equip knowledge and skill sets in the rapidly evolving Infrastructure domain and to resolve the risk factors in successful implementation	
Unit - I	Basic Concepts of Infrastructure:	9
Infrastructure - Definition and types - An overview of the Power sector - Water supply and Sanitation sector - Road, rail, air and port transportation sectors telecommunications sector - urban infrastructure - Rural infrastructure in India - An introduction to special economic zones.		
Unit - II	Private Involvement in infrastructure:	9
Infrastructure privatization- benefits of infrastructure privatization- problems with infrastructure privatization - Challenges in privatization of water supply- challenges in privatization of power - Privatization of infrastructure in India - Privatization of road transportation infrastructure in India.		
Unit - III	Infrastructure Planning and Implementation:	9
Mapping and facing the landscape of risks in infrastructure projects - Economic and Demand risks - Political risks - Socio-Environmental risks - Cultural risks in international infrastructure projects - Legal and contractual issues in infrastructure - Challenges in construction and maintenance of infrastructure.		
Unit - IV	Infrastructure Financing and Risk Management:	9
An overview of infrastructure project finance - Procurement process, concession - Design and award, financial risk analysis, management and mitigation - risk management framework for infrastructure projects - Shaping the planning phase of infrastructure projects to mitigate risks - Designing sustainable contracts.		
Unit - V	Infrastructure project implementation:	9
Sustainable development of infrastructure - Information technology and systems for successful infrastructure management - Innovative design and maintenance of infrastructure facilities - Infrastructure modeling and life cycle analysis techniques - Capacity building and improving the Governments role in infrastructure implementation.		

Lecture: 45, Total: 45**REFERENCES:**

1.	David I. Cleland and Roland Gareis, "Global Project Management Handbook: Planning, Organization and Controlling International Projects", 2 nd Edition, McGraw Hill Series, 2006.
2.	Jeffrey L. Beard, Edward C. Wundran, Michael C. Loulakis, "Design, Build: Planning through development", 1 st Edition, McGraw Hill Series, 2001.
3.	Richard Lambeck, John Eschemuller, "Urban Construction Project Management", 1 st Edition, McGraw Hill Series, 2009.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	elucidate the basic concepts related to infrastructure management	Understanding (K2)
CO2	discover the benefits and problems associated with infrastructure privatization	Applying (K3)
CO3	identify the challenges of infrastructure implementation	Applying (K3)
CO4	assess the financial risk and suggest the suitable mitigation measures	Applying (K3)
CO5	choose the strategies for successful implementation of infrastructure projects	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	3		3		3
CO3	3		3		3
CO4	3		3		3
CO5	3		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PE	3	0	0	3

Preamble	To recall the facts and concepts of project, quality and safety management with Database models and softwares	
Unit - I	Introduction to Project:	9
Concept of a Project – Characteristic features – Project Life cycle – Phases – Project Management – Tools and techniques for project management – Role of project managers- Organization structure.		
Unit - II	Project Initiation:	9
Capital investments - Capital budgeting – feasibility study – preliminary analysis – market, technical, financial, economic and ecological – Market and Demand analysis - Detailed technical analysis		
Unit - III	Project Budget:	9
Cost Control Problem - Project Budget - Forecasting Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows – Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.		
Unit - IV	Quality and Safety Management:	9
Quality and Safety Concerns in Construction -Organizing for Quality and Safety – Work and Material Specifications – Safety measures- Safety management in construction projects		
Unit - V	Project Information:	9
PMIS Report -Integrated Approach for the Management-Distribution of Project Information - Database Models-Information and Transfer Flow		

Lecture: 45, Total: 45**REFERENCES:**

1.	Chitkara K.K., “Construction Project Management: Planning, Scheduling and Control”, 18 th Edition, Tata McGraw-Hill, New Delhi, 2008.
2.	Calin M. Popescu, Chotchai Charoenngam, “Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications”, 1 st Edition, Wiley, New York, 1995.
3.	Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders”, 2 nd Edition, Prentice Hall, Pittsburgh, 2000.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Interpret owner views on a project	Understanding (K2)
CO2	Draft the technical, financial, market and ecological reports	Understanding (K3)
CO3	Forecast the cost accounts and scheduled budgets	Applying (K3)
CO4	Suggest suitable quality control methods and safety in construction	Understanding (K3)
CO5	Evaluate PMIS report and monitor transfer flow	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2			2
CO2	2	3			2
CO3	3	2			2
CO4	2	3			2
CO5	2	3			2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	25	35	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PE	3	0	0	3

Preamble	To evaluate the importance of structural systems in Construction of building, Infrastructure and other special structures	
Unit - I	Structural System:	9
Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and specification.		
Unit - II	Environmental Aspects and Services:	9
Qualities of enclosure necessary to maintain a specified level of interior environmental quality – Weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – Illumination.		
Unit - III	System Integration:	9
Relevant systems integration with structural systems, Plumbing – Electricity – Vertical circulation and their interaction. Technological and methodological demands on construction management in infrastructure development projects.		
Unit - IV	Construction and Infrastructure:	9
Construction component of various infrastructure sectors - highway - Ports and aviation - Oil and gas - Power – Telecom - Railways - Irrigation. Current scenario - future needs.		
Unit - V	Building Information Modeling:	9
Introduction to BIM fundamentals - Modeling of Building Elements: modeling exterior and interior walls, creating floors and roofs, Adding doors, windows, footings, columns, and beams. Introduction to Revit Architecture.		

Lecture: 45, Total: 45**REFERENCES:**

1.	Muthu Shoba Mohan G., "Principles of Architecture", 1 st Edition, Oxford University Press, New Delhi, 2006.
2.	Kochnar, Sammer and Phatak, Deepak B., "Infrastructure and Governance", Academic Foundation, Darya Gang, New Delhi, 2006.
3.	Nawari and Kuenstle, "Building Information Modeling (BIM): A Framework for Structural Design", 1 st Edition CRC Press, Taylor and Francis Group, 2015.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

CO1	identify the structural systems with economical way of selecting materials	Remembering (K1)
CO2	validate the aspects of environmental quality and its specifications	Analyzing (K4)
CO3	select appropriate technology to implement infrastructure development projects	Understanding (K2)
CO4	list the construction components for various infrastructure projects	Remembering (K1)
CO5	summarize the importance of modeling software	Remembering (K1)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2	3	
CO2	2		3	2	
CO3	3		2	3	
CO4	2		3	2	
CO5	3		2	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	25	25	20			100
CAT2	25	55	10	10			100
CAT3	50	50					100
ESE	50	50					100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PE	3	0	0	3

Preamble	To develop and design the infrastructure facilities for societal needs	
Unit - I	Introduction:	9
Real estate projects - Types of real estate projects - Significance - Project management important in commercial real estate - Network Budget management - Time management - Risk management and communications issues.		
Unit - II	Stages of Plannings:	9
Real Estate Strategy, Planning and Analysis - Requirements- Experience and skills - Stages - Land Banking - Land Packaging - Land Development - Building Development - Building Operation - Renovation Stage and Redevelopment Stage.		
Unit - III	Development and Acquisition:	9
Development -Acquisition Tasks- Financing- Market Studies and Marketing Strategies- Environmental Requirements- Approvals and Permits- Improvements- Transportation and Accessibility Consideration- Disposition-Construction Management for Developers and Owners-Project Management Challenges in Real Estate Acquisition Projects		
Unit - IV	Project Management Framework and Anatomy:	9
Preliminary Planning - Planning and Development-Construction Management-Anatomy -Cost-Schedule and Contractor Management-Quality Control-Risk Management-Completion-software-Tracking- integration.		
Unit - V	Evaluation Alternative Investments:	9
Assessing of Real Estate projects - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – Inflation-case studies.		

Lecture: 45, Total: 45**REFERENCES:**

1.	Bruggeman Fishr, "Real Estate, Finance and Investment", 15 th Edition, McGraw Hill, 2015.
2.	Patel B.M., "Project management - Strategic Financial Planning, Evaluation and Control", 2 nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2000.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	estimate project time including risk and budget	Applying (K3)
CO2	build strategy for planning and analysis	Understanding (K2)
CO3	classify marketing strategies and requirements	Understanding (K2)
CO4	frame cost-schedule network	Understanding (K2)
CO5	assess real estate projects with additional taxes	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		2		2
CO2	2		3		2
CO3	3		2		2
CO4	2		3		2
CO5	3		2		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PE	3	0	0	3

Preamble	To assimilate the concepts of GIS and its applications in construction industry	
Unit - I	Introduction to GIS:	9
Introduction - component of GIS - input data - data acquisition - geo referencing - spatial data structures - modeling surfaces – networks - Spatial data analysis: data integration - spatial interpolation - surface analysis - network analysis - digital terrain visualization - Global Positioning System(GPS) and Ground Penetrating Radar (GPR).		
Unit - II	GIS Data:	9
Field data - Statistical data, maps, aerial Photographs, satellite data, points , lines, and areas features, vector and raster data, data entry through keyboard, digitizer and scanners, preprocessing of data rectification and registration, interpolation techniques - Advantages of GIS - Commercially available GIS hardware and Software.		
Unit - III	Global Positioning System:	9
Introduction - GPS Segments: Spaces Segment, Control Segment, User Segment Features of GPS Satellites - Principle of Operation surveying with GPS - Methods of observations, Absolute Positioning, Relative Positioning, differential GPS Receivers - Navigational Receivers, Surveying Receivers, Geodetic Receivers - Computation of Co-ordinates: Transformation from Global to Local Datum , Geodetic Coordinates to map co-ordinates, GPS Heights and mean sea level Height - Applications of GPS.		
Unit - IV	Applications in Civil Infrastructure Management:	9
GIS based planning and data base management in civil infrastructure - GIS in Transportation infrastructure management-Intelligent Transport System - Case Study , Urban Transport Planning, Highway Alignment, Traffic Congestion analysis and Accident Studies – Integration of GIS-ARC GIS		
Unit - V	Applications of GIS in Construction Management:	9
Emerging trends in building automation and control systems for facility management - Construction material procurement - Site layout and Inventory Management - Reducing construction waste and improving construction efficiency - Case Studies.		

Lecture: 45, Total: 45**REFERENCES:**

1.	Ruqayah Hadi ,” GIS in Construction Management: Application of GIS for Preparing the BOQ for Construction Projects”, LAP Lambert Academic Publishing, 1 st Edition, 2016.
2.	Gopi Satheesh,” Advanced Surveying: Total Station, GPS, GIS & Remote Sensing”, Pearson Education, 2 nd Edition, 2017.
3.	S S Manugula,” Photogrammetry GIS and Remote Sensing”, Edu creation Publishing, 1 st Edition, 2018.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	summarize the base concepts of Geographical information System	Understanding (K2)
CO2	categorize GIS Data Classification	Understanding (K2)
CO3	differentiate the integration of GIS and GPS	Understanding (K2)
CO4	relate the application of GIS	Analyzing (K4)
CO5	suggest suitable applications of GIS in the field of Construction Management	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		2		3
CO3	2		2		3
CO4	2		3		2
CO5	2		2		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	34	66					100
CAT2	20	30	30	20			100
CAT3	20	30	30	20			100
ESE	30	30	30	10			100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PE	3	0	0	3

Preamble	To emphasize role of personnel function in construction firms, to give basis of personnel management, man power planning, Labour laws and industrial relations.	
Unit - I	Manpower Management:	9
Manpower Planning – Importance – Requirement –Process – Organizing - Staffing- Directing- Controlling –Factors Influencing Supply and Demand of Human Resource- Role of HR Manager – Personnel Principles – Recruitment – Sources – Selection Process.		
Unit - II	Human Relations and Organizational Behavior:	9
Basic individual psychology – Interpersonal Relations – Leadership – Communication and negotiation skills- Personality and creativity- Group Dynamics – Team Building		
Unit - III	Stress, Conflict, Performance, Time and Motivation:	9
Stress – Causes – Managing Stress – Conflicts – Causes – Management Managing Conflicts-Performance Appraisal – Horizontal – Vertical - 3600 – Methods of Improving Performance Appraisal- Time Management – Styles- Techniques – Motivation – Types – Analysis		
Unit - IV	Training and Development:	9
Training and Development – Objectives – Need- Training Process – Methods-Tools and Aids – Evaluation of Training Program		
Unit - V	Welfare Measure:	9
Overview of Labour Laws in India-Industrial Disputes Act – Grievance Handling – Enquiry Procedure- Compensation – Incentives – Pension –GPF –EPF – Group Insurance		

Lecture: 45, Total: 45

REFERENCES:

1.	Memori1a,C.B., "Personnel Management", 12 th Edition Himalaya Publishing House Pvt.Ltd., 2012
2.	Monappa A. & M.S. Saiyadaui , "Personnel Management" ,Tata McGraw Hill,2006
3.	Martin loosemore, "Human Resource Management in Construction Projects", Spon Press,2003

COURSE OUTCOMES:	BT Mapped
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On completion of the course, the students will be able to		(Highest Level)
CO1	relate the importance of planning	Understanding (K2)
CO2	develop the interpersonal skills	Applying (K3)
CO3	recognize the need of performance and motivation	Understanding (K2)
CO4	categorize the need of training and development	Understanding (K2)
CO5	classify the legal concepts in construction industry	Understanding (K2)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		2		2
CO2	2		3		2
CO3	2		3		2
CO4	2		3		2
CO5	3		2		2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	53	27				100
CAT2	15	65	20				100
CAT3	20	66	14				100
ESE	20	56	24				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PE	3	0	0	3

Preamble	To plan and detail the components of formwork with various accessories and classify the shores	
Unit - I	Elements for Formwork:	9
Overall and Detailed Planning - Units - Schedule for column formwork - Formwork elements - Development of basic system - Economical formwork construction.		
Unit - II	Form Work and Scaffolding Accessories:	9
Crane arrangement - Formwork beams - Formwork ties - Wales - Scaffold frames - Form accessories - Vertical transport table form work - Advantages - Functions of various components - Planning of Slip form operations.		
Unit - III	Shoring for Buildings:	9
Type of shores - Size and spacing - Safety practices - Horizontal shores - Deflection, bending and lateral stability - Shear, Bearing - Examples in wall forms - Slab forms - Beam form - Ties, Anchors and Hangers - Column forms.		
Unit - IV	Materials for Shoring Shuttering and Form:	9
Lumber - Types - Finish - Sheathing boards - Plywood - Reconstituted wood - Steel -Aluminium - Form lining materials - Hardware and fasteners - Pressures on Formwork -Temperature - Rates of Placing - Consistency of concrete – Vibration- Advanced Materials used for formworks		
Unit - V	Safety Practices for Forms and its Types:	9
Form for shell structures - Curb and Invert forms - Arch and Wall - Slipforms - Principles - Types of scaffolds - General safety requirements - Precautions against particular hazards - Scaffolding systems.		

Lecture: 45, Total: 45

REFERENCES:

1.	Peurifoy Robert L., and Oberlender Garold D., "Formwork for Concrete Structures", 3 rd Edition, McGraw-Hill, New York, 1996.
2.	Hurd M.K., "Formwork for Concrete", 6 th Edition Special Publication No. 4. American Concrete Institute, Detroit, 1995.
3.	Austin C.K., "Formwork for Concrete", 4 th Edition, Cleaver - Hume Press Ltd., London, 1996.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	design economical formwork	Applying (K3)
CO2	distinguish various formwork components	Understanding (K2)
CO3	classify different types of shores, beams and slab forms	Understanding (K2)
CO4	estimate the different types of finishing materials and advanced materials used for formworks	Applying (K3)
CO5	apply the safety practices meant for formwork construction	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2			2		3
CO3	2		3		3
CO4	2		2		3
CO5	2		2		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40				100
CAT2	20	30	50				100
CAT3	20	25	55				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

20CME11– SYSTEM INTEGRATION IN CONSTRUCTION

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
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Prerequisites	Nil	3	PE	3	0	0	3
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Preamble	To study the various models of management information systems and their application to project management.	
Unit - I	Structural Integration:	9
Structural System - Current areas of research - Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification - Profession of building in construction – Standards and Importance.		
Unit - II	Environmental Factors:	9
Qualities of enclosure necessary to maintain a specified level of interior environmental quality – Weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – illumination – Relevant systems integration with structural systems.		
Unit - III	Building Services and Safety:	9
Building Services and Safety - Ability of systems to protect fire - Preventive systems - Fire escape system design - Planning for pollution free construction environmental - Hazard free construction execution. Plumbing - Electricity - Vertical circulation and their interaction.		
Unit - IV	Tools and Requirements:	9
Approaches Tools and Techniques in system integration - Current problems and requirements in construction industry - System Integration Tips and Benefits in Buildings.		
Unit - V	Designing and Software:	9
Future research opportunities - Software such as BAS-CMMS-Security software, and building performance visualization software - Designing Integration into New Construction - Early Owner Involvement is a Key to Success in construction.		

Lecture: 45, Total: 45

REFERENCES:

1.	David V.Chadderton, "Building Services Engineering", 6 th Edition, Routledge, 2013.
2.	Peter R. Smith and Warren G. Julian, "Building Services", Applied Science Publishers Ltd., London, 1993.
3.	Derek Clements-Croome & Thomas Telford , "Intelligent Buildings: Design, Management and Operation", 2 nd Edition, Thomas Telford Publisher, London,2004.

COURSE OUTCOMES:

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**



CO1	adopt the system integration, services and maintenance	Understanding (K2)
CO2	design the structure with least possible maintenance	Applying (K3)
CO3	plan the structure with essential building services	Understanding (K2)
CO4	rectify the hazardous area in construction and adopt safety measures	Understanding (K2)
CO5	identify appropriate tools and techniques required for system integration	Understanding (K2)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		3		2
CO2	3		3		2
CO3	3		3	2	3
CO4	3		3		2
CO5	3		3		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	25	25	50				100
CAT3	50	50					100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

20CME12– RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

Programme &	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
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Branch							
Prerequisites	Nil	3	PE	3	0	0	3

Preamble	To impart knowledge in managing the resources effectively towards the successful completion of the project	
Unit - I	Resource Planning:	9
Resource Planning - Stages of Planning - Procurement - Identification - Planning for material - Labour - Time schedule and cost control - Types of resources.		
Unit - II	Resource Management:	9
Systems approach in resource management-Characteristics of resources- Resources Utilization- Measurement of actual resources required-Tools for measurement of resources - Classes of Labour- Labour Productivity - Cost of Labour- Labour Schedule.		
Unit - III	Time and Cost Management:	9
Time and quality - Management and Planning - Managing Time on project-forecasting the future-Critical path measuring the changes and their effects- Cash flow and Cost Control, Objectives of Cost Control.		
Unit - IV	Materials And Equipments:	9
Time of Purchase- Quantity of Material- Sources- Transportation- Delivery and Distribution. Equipment: Planning and Selecting by Optimistic Choice With Respect to Cost and Time- Source and Handling - Depreciation of Construction Equipment.		
Unit - V	Resource Allocation and Levelling:	9
Time-Cost Trade Off - Computer Application in Resource levelling - Resource List - Resource Allocation - Resource Smoothing- Resource Loading – Calculation of EAC and ETC –Value Management.		

Lecture: 45, Total: 45

REFERENCES:

1.	Canter M.R., "Resource Management for Construction", 1 st Edition, Macmillan International Higher, London, 1993.
2.	Kumar Neeraj Jha, "Construction Project Management", 2 nd Edition, Pearson India Education Services, New Delhi, 2018.
3.	Sears Glenn A., "Construction Project Management", 6 th Edition, John Wiley & Sons Inc., New Jersey, 2015.

COURSE OUTCOMES:

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**



CO1	identify the resources needed for a construction project	Understanding (K2)
CO2	plan the resource based on the requirement	Applying (K3)
CO3	relate the factors that have an effective control over time and cost	Understanding (K2)
CO4	suggest a suitable equipment for a construction activity	Applying (K3)
CO5	implement value management concepts in construction projects	Applying (K3)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1			3		2
CO2	3		2		2
CO3	2		3		
CO4			3		2
CO5	2		3		2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	50	30				100
ESE	20	60	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

20CME13– IPR AND PATENTING

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3



Preamble	To make the student aware about new concepts and importance of patenting in research and development	
Unit - I	Introduction to Intellectual Property Rights (IPR):	9
Concept and Meaning of Intellectual Property Rights-Nature and Characteristics of IPR-Origin and Development - Theories - Philosophical aspects.		
Unit - II	International Institutions and Basic International Conventions:	9
Paris Convention for the Protection - The Berne Convention - TRIPS Agreement-International Institutions Concerned with Intellectual Property.		
Unit - III	Contemporary Issues in IPR:	9
Interface between IPR with Human Rights - Competition Law- Sustainable development -The Impact of Internet on IPR - IPR Issues in Biotechnology- E-Commerce and IPR issues		
Unit - IV	Basics of Patents	9
Definition of Patents, Copy right - Conditions of patentability, Patentable and non-patentable inventions, Types of patent application - Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent		
Unit - V	Procedure for Filing a Patent (National and International):	9
Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication Time frame and cost, Patent Licensing - Tangible and Intangible Properties in patent.		

Lecture: 45, Total: 45

REFERENCES:

1.	R Radha Krishnan & S Balasubramanian, "Intellectual Property Rights", 1st Edition, Excel Books
2.	M Ashok Kumar and mohd Iqbal Ali, "Intellectual Property Rights", 2nd Edition, Serial Publications
3.	N S Rathore, S M Mathur, Priti Mathur, Anshul Rathi, "IPR: Drafting, Interpretation of Patent Specifications and Claims", New India Publishing Agency

COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1	aware of the concepts of IPR	Understanding (K1)
CO2	acquire knowledge about international conventions	Remembering (K1)



CO3	derive the interface between IPR and human rights	Understanding (K2)
CO4	draft and file the applications of patents	Understanding (K2)
CO5	frame policies and patents	Understanding (K2)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		2		2
CO2	3		3		2
CO3	2		3		2
CO4	2	2	3		2
CO5	3	2	2		2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	50	25				100
CAT2	25	40	35				100
CAT3	25	40	35				100
ESE	25	45	30				100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To impart the importance of safety and safety practices in construction	
Unit - I	Construction Safety Management:	9
Safety in construction operations - Safety in use of construction equipment - General trades and their occupational hazards - Fire safety in buildings - Causes of fire hazards - fire control devices - Technologies and equipments.		
Unit - II	Designing for Safety:	9
Safety Culture - Safe Workers - Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Company activities in Safety - Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation.		
Unit - III	Safety Policies and Contractual Obligations:	9
Study of safety policies - Study of various IS codes - Operations of construction and OSHA guidelines - Safety in Construction Contracts – Substance Abuse – Safety Record Keeping - Workmen Compensation Act.		
Unit - IV	Safety Programme:	9
Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives.		
Unit - V	Safety During Construction:	9
Safety concern in construction - Role of owners in safety and health management - Proactive position as an owner -Allocation of responsibility for safety - Fostering total safety culture - Job site safety - Additional concerns of owners.		

Lecture: 45, Total: 45

REFERENCES:

1.	Jimmy W. Hinze, "Construction Safety", 1 st Edition, Prentice Hall Inc., 1997.
2.	Richard J. Coble, Jimmie Hinze and Theo C. Haupt, "Construction Safety and Health Management", 1 st Edition, Prentice Hall Inc., 2001.
3.	Amarjit Singh, "Implementation of Safety and Health on Construction Site", 1 st Edition, A.A. Balkema Publishers, Netherlands, 1999.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	identify various construction activities prone to accidents	Applying (K3)
CO2	illustrate various constructions safety concepts	Understanding (K2)
CO3	assess the causes of construction site accidents	Applying (K3)
CO4	plan effective safety programme	Applying (K3)
CO5	interpret various safety practices among personnel involved in projects	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		3		2
CO2	3		3		3
CO3	3		2		2
CO4	3		3		2
CO5	2		3		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40				100
CAT2	30	30	40				100
CAT3	20	40	40				100
ESE	20	30	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20CME15– BUILDING INFORMATION MODELLING**

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To create knowledge on different levels of BIM and model based workflows through different aspects of building modelling.	
Unit - I	Introduction to BIM:	9
Definition - Guidelines - Different levels of BIM - BIM object - BIM model - Softwares for BIM - Benefits - BIM challenges		
Unit - II	BIM workflow in Building Lifecycle:	9
Planning and 3D modelling - Model based cost estimating - Construction scheduling and 4D simulation - Design co-ordination - BIM to the field.		
Unit - III	Dimensional Aspects in BIM:	9
Visualization (3D) - Time (4D) - Cost (5D) - Operation (6D) - Sustainability (7D) - Safety (8D) - Advancements in various dimensions.		
Unit - IV	Building Structural System:	9
Building Enclosures - Functional Aesthetic System - Thermal Infiltration - Illumination - Acoustic Control - Weather Resistance.		
Unit - V	Integrated Design Infrastructure using BIM:	9
Various Infrastructure Sectors - Highways - Railways - Ports and Aviation - Oil and Gas - Power - Telecom - Irrigation - Current Scenario and future needs.		

Lecture: 45, Total: 45**REFERENCES:**

1.	Brad Hardin, Dave McCool, "BIM and Construction Management", 2 nd Edition, Wiley Publications, 2001.
2.	Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston "BIM Handbook", 2 nd Edition, Wiley Publications, 2008.
3.	Ray Crotty, "The Impact of Building Information Modelling", 1 st Edition, SPON Press, USA, 2012.

COURSE OUTCOMES:	BT Mapped
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On completion of the course, the students will be able to		(Highest Level)
CO1	interrogate the different levels of BIM and related softwares	Understanding (K2)
CO2	plan a model based cost estimation for buildings	Applying (K3)
CO3	identify different dimensional aspects of BIM	Understanding (K2)
CO4	associate the building structural system with building modelling.	Applying (K3)
CO5	relate other infrastructures design using BIM	Understanding (K2)

Mapping of COs with POs and PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1					3
CO2	3		3	3	3
CO3			3	2	2
CO4	3		2	2	2
CO5	2		2	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy					

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	25	25				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	40	30				100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To equip the students with knowledge about the Advanced Construction Techniques adopted in the industry	
Unit - I	Construction Techniques:	9
Reinforced and pre-stressed concrete construction: Introduction - Mechanized methods of earthwork - Estimation of quantities of earthwork in grading - Grading of sites - Blasting methods - Fabrication of reinforcement and transportation of erected reinforcement - Introduction to pre-stressed concrete - Types of pre-stressing – Advantages - Methods of pre-stressing and Equipment for pre-stressing operation.		
Unit - II	Construction of Prefabricated Structures:	9
Introduction to Prefabricated structures - Planning for pre-casting - Selection of equipment for fabrication - Transport and erection of prefabricated components - Quality measures - Design considerations of precast elements - Safety measure during erection.		
Unit - III	Construction of Special Structures :	9
Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks		
Unit - IV	Modular Construction and High Rise Buildings:	9
Introduction to modular construction - Modular coordination - Modular standardization - Modular system building – Limitation - Advantages and disadvantages of modular construction.		
Unit - V	Rehabilitation and Strengthening Techniques:	9
Offshore and port technology - Coast preservation technique - Facilities crossing a strait or a sea area - Foundation technology - Soil improvement techniques - Shield tunneling technology Earth-retaining excavation technique.		

Lecture: 45, Total: 45**REFERENCES:**

1.	Robert Wade Brown, "Practical Foundation Engineering Handbook", 2 nd Edition, McGraw Hill Publications, 2001.
2.	William P. Spence, "Construction Materials, Methods and Techniques", 3 rd Edition, Delmar Publications, 2010.
3.	Roy Chudley, "Advanced Construction Technology", 5 th Edition, Pearson Publications, 2015.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	estimate the quantities of earthwork in grading and grading sites	Understanding (K2)
CO2	discuss the construction sequence of prefabricated structures	Understanding (K2)
CO3	summarize the procedure of constructing special structures	Understanding (K2)
CO4	identify the need of modular construction in the construction era	Understanding (K2)
CO5	assimilate the need for rehabilitation and strengthening techniques	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2		3
CO2	2		2		3
CO3	3		3		3
CO4	2		2	2	3
CO5	2	2	2		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	50	50					100
CAT3	50	50					100
ESE	50	50					100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

20CME17– MAINTENANCE AND REHABILITATION OF STRUCTURES

Programme &	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
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Branch							
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To identify the causes of deterioration and consequent modern rehabilitation strategy at optimum cost	
Unit - I	General Aspects:	9
Performance of construction materials and components in actual structure for strength, permeability, thermal properties and cracking effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, Effects of cover thickness.		
Unit - II	Maintenance and Diagnosis of Failure:	9
Maintenance, Repair and rehabilitation, Facets of Maintenance, Importance of Maintenance, Various aspects of inspection - Assessment procedure for evaluating a damaged structure. Diagnosis of construction failures.		
Unit - III	Materials and Techniques for Repair:	9
Special concretes and mortar - concrete chemicals - Expansive cement - polymer concrete - sulphur infiltrated concrete - Ferro cement - Fiber reinforced concrete - mortar and dry pack - vacuum concrete - Guniting and Shotcrete - Epoxy injection - Mortar repair for cracks - rust eliminators and polymer coating for rebars - Methods of corrosion protection - corrosion inhibitors - corrosion resistant coatings.		
Unit - IV	Modern Techniques of Retrofitting:	9
Structural first aid after a disaster – jacketing - use of chemicals in repair - application of polymers - ferrocement and fiber concrete as rehabilitation materials - strengthening by prestressing - shoring and underpinning - Retrofitting of earthquake affected buildings - Retrofitting of bridges.		
Unit - V	Post repair Maintenance of Structures:	9
Protection and Maintenance schedule against environmental distress to all those structures - Special cares in rehabilitation of heritage structures - high rise buildings - bridges and other special structures.		

Lecture:45, Total:45

REFERENCES:

1.	Dayaratnam P. and Rao R., "Maintenance and Durability of Concrete Structures", 1st Edition, University Press, India, 1997.
2.	Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", 1st Edition, Longman Scientific and Technical, UK, 1991.
3.	Dodge Woodson R., "Concrete Structures – protection, repair and rehabilitation", 1st Edition, Elsevier Butterworth – Heinmann, UK, 2009.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

CO1:	explain the concepts related to maintenance management	Understanding (K2)
CO2:	choose repair and maintenance strategies for structures	Applying (K3)
CO3:	apply suitable post repair techniques for special structures	Applying (K3)
CO4:	adopt appropriate pre-stressing technique for special structures	Applying (K3)
CO5:	select the maintenance strategies for special structures	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		3		
CO2	3		3		
CO3	3		3		
CO4	3		3		
CO5	3		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	15	25	60				100
CAT3	20	30	50				100
ESE	20	30	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20CME18– GREEN BUILDING MANAGEMENT**

Programme & Branch	M.E. & Construction Engineering and Management	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To impart knowledge on Eco friendly building concepts and Building certification systems as per Indian and International Standards	
Unit - I	Introduction to IGBC and Green Building Concept:	9
Green Building Concept- Introduction to IGBC- Green Building Rating Tools - Green Project Management and Certification Documentation and Certification		
Unit - II	Introduction to Green Rating Systems:	9
History of green Rating systems - LEED, GRIHA, BREEAM, IGBC - Need and use of green rating systems - Structure of the rating systems - Market response to various rating systems - Selection of the appropriate rating system.ZEB-NZEB-ZCB ratings		
Unit - III	Alternative Construction Materials and Methods:	9
Building and Material Reuse - Salvaged Materials - Material Content - Manufactured Materials - Recycled Content – Eco Block - Volatile Organic Compounds (VOC's) Natural Non-Petroleum Based Materials - Alternative Construction Methods - Waste Management and Recycling - Design For Deconstruction		
Unit - IV	Performance Testing:	9
Cost and Performance Comparisons and Benchmarking - Building Modeling & Energy Analysis - Cost Benefit Analysis - Energy, Shell and Systems Installation Testing - Blower Door - Duct Tightness - Thermal Imagery - Air Quality - Moisture Testing - Commissioning, Metering, Monitoring -Weatherization - Air Sealing – HVAC - Moisture Control - Energy Retrofits and Green Remodels		
Unit - V	Future of Building Rating Systems:	9
Role of Green building consultant - Determining the various green points - Green Accreditation examinations - Energy modeling and energy auditing in green building ratings - Consultancy scope and services for green rating systems - Codes and Certification Programs - Green Rating Registration - Green Remodel Ratings - International Green Construction Codes and ratings – Service life span - Case Study		

Lecture: 45, Total: 45**REFERENCES:**

1.	Linda Reeder, "Guide to green building rating systems ", John Wiley & Sons, 3 rd Edition 2010.
2.	Dru Meadows, " Preparing a Building Service Life Plan for Green Buildings", McGraw-Hill Publications, 1 st Edition, 2014.
3.	Abe Kruger, " Green Building: Principles and Practices in Residential Construction", Cengage learning India Pvt Ltd, 1 st Edition, 2012.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	familiarize the concepts of green building	Understanding (K2)
CO2	gain knowledge on existing green building rating systems	Understanding (K2)
CO3	identify alternate construction materials and methods	Understanding (K2)
CO4	rate the green buildings	Evaluating (K5)
CO5	re-frame the codes for certification of green construction.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		3		
CO2	3		3		
CO3	3		3		
CO4	3		3		
CO5	3	3	3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	65					100
CAT2	20	30	30	20			100
CAT3	20	30	30	20			100
ESE	30	30	30	10			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



Programme & Branch		All ME/MTech, MCA Programmes	Sem.	Category	L	T	P	Credit
Prerequisite		Nil	4	PE	3	0	0	3
Preamble	This course will direct the students on how to employ their innovations towards a successful entrepreneurial venture development.							
UNIT – I	Innovation and Entrepreneurship:							9
Creativity and Innovation – Types of innovation – challenges in innovation- steps in innovation management- Meaning and concept of entrepreneurship - Role of Entrepreneurship in Economic Development - Factors affecting Entrepreneurship – Entrepreneurship vs Intrapreneurship								
UNIT – II	Design Thinking and Product Design:							9
Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test. Design thinking tools: Analogies – Brainstorming – Mind mapping. Techniques and tools for concept generation, concept evaluation – Product architecture – Minimum Viable Product (MVP)- Product prototyping – tools and techniques– overview of processes and materials – evaluation tools and techniques for user-product interaction								
UNIT – III	Business Model Canvas (BMC) and Business Plan Preparation:							9
Lean Canvas and BMC - difference and building blocks- BMC: Patterns – Design – Strategy – Process–Business model failures: Reasons and remedies. Objectives of a Business Plan - Business Planning Process and Preparation								
UNIT – IV	IPR and Commercialization:							9
Need for Intellectual Property- Basic concepts - Different Types of IPs: Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design– Patent Licensing - Technology Commercialization – Innovation Marketing								
UNIT – V	Venture Planning and Means of Finance:							9
Startup Stages - Forms of Business Ownership - Sources of Finance – Idea Grant – Seed Fund – Angel & Venture Fund – Institutional Support to Entrepreneurs – Bank and Institutional Finance to Entrepreneurs								

Total : 45**REFERENCES:**

1.	Gordon E. & Natarajan K., "Entrepreneurship Development", 6th Edition, Himalaya Publishing House, Mumbai, 2017.
2.	Sangeeta Sharma, "Entrepreneurship Development", 1st Edition, PHI Learning Pvt. Ltd., New Delhi, 2017.
3.	Charantimath Poornima M., "Entrepreneurship Development and Small Business Enterprises", 3rd Edition, Pearson Education, Noida, 2018.
4.	Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, "Entrepreneurship", 10th Edition, McGraw Hill, Noida, 2018.



COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	understand the relationship between innovation and entrepreneurship	Understanding (K2)
CO2:	understand and employ design thinking process during product design and development	Analysing (K4)
CO3:	develop suitable business models as per the requirement of the customers	Analysing (K4)
CO4:	Practice the procedures for protection of their ideas' IPR	Applying (K3)
CO5:	understand and plan for suitable type of venture and modes of finances	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	2	1	3	2		1	1	
CO2	1	2			3	2	1						1	
CO3	3	1	3			1							1	
CO4	1	2				3							1	
CO5	1	2				3							1	
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	40	20				100
CAT2	30	40	30				100
CAT3	30	45	25				100
ESE	30	40	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)