BIRLA VISHVAKARMA MAHAVIDYALAYA

(ENGINEERING COLLEGE)

(AN AUTONOMOUS INSTITUTION)

VALLABH VIDYANAGAR – 388120, GUJARAT

AFFILIATED TO GUJARAT TECHNOLOGICAL UNIVERSITY

ACADEMIC REGULATIONS

AND

COURSES OF STUDY

FOR

POST GRADUATE DEGREE PROGRAMME LEADING TO

MASTER OF TECHNOLOGY (M. TECH.)

IN

CONSTRUCTION ENGINEERING AND MANAGEMENT

For the students admitted during Academic Year 2015-18

OCTOBER – 2018

Contents

Institute Vision

"Produce globally employable innovative engineers with core values."

Institute Mission

- Re-engineer curricula to meet global employment requirement
- Promote innovative practices at all levels.
- Imbibe core values
- Reform policies, systems and processes at all levels.
- Develop faculty and staff members to meet the challenges

Core Values

Quality, Creativity, Team Work, Lifelong Learning, Pro-activeness, Cost Consciousness, Sharing, Transparency

Academic Regulations

FOR POST GRADUATE PROGRRAMMES

AR(PG) 1 ADMISSION

AR(PG) 1.1 A candidate for admission to the two year degree programme for Master of Technology must have eligibility as per the Gujarat Government/ACPC/GTU/CVM rules.

AR(PG) 1.2 Admission granted to an applicant is to be considered provisional until all the fees are paid and all the prescribed documents are in order. BVM Engineering College **DISCLAIMS ALL RESPONSIBILITIES** if any of the documents required as per ACPC/ Gujarat Technological University requirements are not submitted or found unacceptable by it. The college will not accept responsibility for students who do not submit the expected examination/ registration forms in time.

AR(PG) 2 PROGRAMMES OF STUDY

AR(PG) 2.1 A student shall follow the prescribed courses as given in the programme of study to which he/she is admitted. These courses for various programmes are listed in Annexure – I.

The syllabi for these courses are given in Annexure – II.

AR(PG) 3 COURSES LEVELS

AR(PG) 3.1 At the commencement of each semester a student shall register for the set of courses he/she intends to pursue during the semester. For the registration process, refer AR (PG) 8.

AR(PG) 3.2 All courses offered are divided into two levels: Level 1 and 2. The levels correspond to successive years of study of a typical M. Tech. student. In other words, a regular student will complete his Level-1 courses during his first year and Level-2 courses during his second year.

AR(PG) 3.3 The list of courses offered in semester will be announced by the college at the beginning of the semester.

AR(PG) 4 PROGRAMME ELECTIVE COURSES

AR(PG) 4.1 Each programme of studies contains a certain number of programme elective courses. Programme elective courses will be offered under each discipline at corresponding level from which a student may choose course(s).

AR(PG) 5 OPEN ELECTIVE COURSES

AR(PG) 5.1 Open elective courses are courses offer by a discipline for students other than the corresponding discipline.

AR(PG) 6 COURSE CREDITS

AR(PG) 6.1 Each course offered has **L-T-P** structure. Whereas, **L** means number of theory lecture hours per week, **T** means number of tutorial hours per week and **P** means number of practical/laboratory hours per week.

AR(PG) 6.2 Total course credits for a course are obtained by adding the hours of theory lectures, tutorials and practical together. E.g. 4-0-2 means a course has 6 credits, 3-2-0 means a course has 5 credits, 2-2-2 means a course has 6 credits.

AR(PG) 7 FACULTY COUNSELOR

AR(PG) 7.1 Each student is assigned to a Faculty Counselor who will advise and counsel him regarding the selection of courses to be registered in a given semester as well as monitor his/ her holistic growth. The final selection of courses made by the student must be approved by his Faculty Counselor.

AR(PG) 8 REGISTRATION

AR(PG) 8.1 To earn course credits in a semester a student must register for the courses at the commencement of the semester.

AR(PG) 8.2 At the commencement of each semester a period of two working days is designated as the registration period. A student must complete his registration formalities within this period as per the procedure laid down.

AR(PG) 8.3 A further period of 12 working days is designated as late registration period. During this period a student shall require to pay late registration fee, as decided by the Institute from time to time, to complete his registration. Late registration will only be permitted on genuine reasons (like medical and other unavoidable circumstances) to be approved by the concerned Head of Department and Principal

AR(PG) 8.4 Student shall not be permitted to attend classes without registration.

AR(PG) 8.5 The registration must be completed by the student in person.

AR(PG) 8.6 A student who has completed all the requirements for his degree will not be allowed to register in any further courses.

AR(PG) 8.7 All registrations in every semester must be duly approved by the concerned Head and Principal of the college.

AR(PG) 9 REQUIREMENTS FOR REGISTRARTION

AR(PG) 9.1 A student can register for a course provided that the following conditions are satisfied:

i) The course is included for the student's assigned programme of studies, or the student has been permitted to take the course as an open elective.

ii) The course is being offered in the semester.

AR(PG) 9.2 The courses selected by the student must be approved by his Faculty Counselor.

AR(PG) 10 MINIMUM ENROLLMENT

AR(PG) 10.1 Under normal circumstances an elective course will be conducted in a semester only if a stipulated minimum number of students have registered for the course as decided by the Board of Studies.

AR(PG) 10.2 An elective course in which the number of student registered is less than the stipulated minimum may be withdrawn from the elective course offering of that semester. The student registered in such a course will be permitted to amend their registration.

AR(PG) 11 ASSESSMENT OF STUDENT PERFORMANCE IN COURSE

AR(PG) 11.1 The performance of a student in a course is judged through (i) continuous assessment of theory, tutorial and practical work and (ii) end-semester theory, tutorial and practical examinations.

AR(PG) 11.2 The end- semester theory examination in a course has a weightage of 70 percent of theory marks. The remaining 30 percent of theory marks will be awarded through continuous assessment carried out during the semester.

AR(PG) 11.3 The end-semester tutorial/practical examination in a course has a weightage of 60 percent of total tutorial/practical marks and continuous assessment of the same carries the remaining 40 percent of total tutorial/practical marks. Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of several of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, end-semester practical examination, attendance, etc.

Continuous assessment (tutorial/practical) scheme is given below:

Term work	20 percent (Equal weightage for every practical. At least 10 practical/ tutorial need to be performed or mini project)
Quiz /Assignment/ Viva/active learning component	20 percent
Total	40 percent

AR(PG) 11.4 The overall performance of student in the course is assessed on the principle of a "single head of passing", i.e., there will be a single grade for a course based upon the aggregate of marks obtained by the student in theory and practical components in continuous assessment as well as end semester examination. However, a student should score minimum 30% marks in end semester examination to make himself/ herself gradable.

Examiner(s) can grace up to 10% of total marks of end semester theory examination in marks of end semester theory examination to make a student gradable by making the resolution of the same in grade sheet. However, grace marks shall not be counted in the aggregate of marks obtained by the student for the grading.

AR(PG) 12 EXAMINATIONS

AR(PG) 12.1 The end-semester examination for all courses offered in each semester of an academic year will be conducted by the Institute.

AR(PG) 12.2 No student shall be allowed to the end semester examination unless he/she has attended minimum 75% of Theory Lectures/ Tutorials/ Practical classes of the course and will be awarded letter grade LA (Ref. AR (PG) 13) in all the subjects he/she has registered in the corresponding semester.

AR(PG) 12.3 The college will conduct two continuous assessment of theory (mid semester examination) in a semester for each subject. The average marks of two mid semester examinations shall be considered as the final marks for continuous assessment of theory.

A student who remains absent in any of the two mid semester examination for whatsoever reason(s) shall be awarded with zero marks in the respective mid semester examination.

However, a student remains absent due to any of the following unforeseen reasons, shall be permitted to appear along with remedial mid-semester examination. The marks of mid semester remedial examination of such students shall be considered as marks of mid semester examination in which he/she remained absent.

a) A student is critically ill or injured. (Student or his/her relative shall get prior approval)
b) Death of direct blood relation relative. (Student or his/her relative shall inform to Head/Principal immediately after the incident and permission will not be granted for more than 24 hours)
c) A student representing Gujarat state in national level events and/or India in international events organized by official boards.

AR(PG) 12.4 No student shall be allowed to appear in the end semester examination of a course unless he/ she scored at least 30% marks in mid semester examination and will be considered in "NOT PERMITTED TO APPEAR (NPTA)" status for the respective course. The NPTA status carries zero grade point in performance index calculation.

Remedial mid semester examination shall be conducted by the department for NPTA students before the beginning of the end semester examination. If a student gets 30% or more marks, he/she shall be "PERMITTED TO APPEAR" in the end semester examination. However, he/she will be awarded only 30% marks in continuous theory assessment. For genuine reasons, if a student remains absent in the mid semester examination and subsequently appear in the remedial examination, the marks scored by the student will be considered as continuous theory assessment marks.

If a student still remains with NPTA status, he/she shall appear in mid semester remedial examination of the next semester.

AR(PG) 12.5 The End Semester tutorial/practical examination shall be rescheduled for a student who is not able to appear in the regular schedule due to following reason.

a) A student is critically ill or injured. (Student or his/her relative shall get prior approval)
b) Death of direct blood relation relative. (Student or his/her relative shall inform to Head/Principal immediately after the incident and permission will not be granted for more than 24 hours)
c) A student representing Gujarat state in national level events and/or India in international events organized by official boards.

However, such rescheduling should be confined within the Academic Calendar of the respective semester.

AR(PG) 12.6 The college will conduct only one continuous assessment of theory (mid semester examination) for all subjects of the semester in the following cases.

a) First Semester of M. Tech.
b) Corresponding semester of the year of transfer for transferred students or international students, if the admission of such students is five week later than commencement of academic calendar.

AR(PG) 13 LETTER GRADES

AR(PG) 13.1 The overall performance of a student in a course is represented by a letter grade from AA to **FF** and **LA** with the following meaning and equivalent grade points:

LETTER GRADE	EQUIVALENT GRADE POINTS	REMARK
AA	10	Outstanding
AB	9	Excellent
BB	8	Very Good
BC	7	Good
CC	6	Average
CD	5	Pass
FF	0	Fail
LA	0	Low Attendance (Fail)

AR(PG) 13.2 A course is completed successfully, i.e., credit is earned for a course, when a letter grade CD or better (in grade points) is obtained in the course.

AR(PG) 13.3 The scheme of awarding letter grades and the letter grades awarded in each course are subjected to scrutiny and approval by Academic Council.

AR(PG) 15 FAILURE IN A COURSE

AR(PG) 15.1 A student earns **zero** credit for a course when he gets letter grade **FF** or **LA** in the course.

AR(PG) 15.2 If letter grade **FF** or **LA** is obtained in an elective course, the student may change the elective.

AR(PG) 15.3 The letter grade **FF** or **LA** obtained in a course will be shown in the final transcript issued to the student (refer AR (PG) 22) whether or not he subsequently obtains another letter grade in a repeat attempt.

AR(PG) 15.4 A student with letter grade LA should repeat the course i.e. he/she should attend theory and practical classes as and when the course is offered.

AR(PG) 15.5 A student with letter grade **FF** should appear in end semester theory as well as practical/ viva exam and should obtain a letter grade **CD** or better (in grade points).

AR(PG) 15.6 A student with more than **four FF grade and/or NPTA status** in a level will not be allowed to move to the next level.

AR(PG) 16 SEMESTER PERFORMANCE INDEX (SPI)

AR(PG) 16.1 The performance of a student in a semester is expressed in terms of the semester Performance Index (SPI).

AR(PG) 16.2 The semester Performance Index is the weighted average of course grade points obtained by the student in the course taken in the semester. The weights assigned to course grade points are the credits carried by the respective courses.

That is,

$$SPI = \frac{\sum_{i=1}^{n} g_i c_i}{\sum_{i=1}^{n} c_i}$$

where, g_i is the equivalent grade point of i^{th} course,

c_i is the credit of the course

n is total number of courses registered by the student in a semester

AR(PG) 17 CUMULATIVE PERFORMANCE INDEX (CPI)

AR(PG) 17.1 The cumulative performance of student is expressed in terms of the Cumulative Performance Index (CPI). This index is defined as the weighted average of course grade points obtained by the student for all courses taken since entry to the programme, where the weights are defined in same way as in AR (PG) 16.

AR(PG) 17.2 If a student repeats a course, only the grade points obtained in the latest attempt are counted towards the Cumulative Performance Index (CPI).

AR(PG) 18 DISCONTINUINACE FROM THE PROGRAMME

AR(PG) 18.1 A Semester Performance Index (SPI) of less than 3.00 in two consecutive semesters shall disqualify a student from continuing his studies. Such a student will be referred to the Academic Council. After considering the extenuating circumstances, if any, the Academic Council shall decide whether the student should be allowed to continue his/ her studies. The Academic Council decision shall be final and binding.

AR(PG) 19 ADMISSION BY TRANSFER

AR(PG) 19.1 For a student admitted by transfer to the M. Tech. programme after completing part of his degree requirements elsewhere or under the previous regulations, the Board of Studies (BOS) shall decide the subjects which he/ she is deemed to have completed and shall be exempted from those subjects. In the grade sheet, the exempted subjects shall be specified as "EXEMPTED".

AR(PG) 19.2 The remaining requirements must be completed by the student in a proportionately smaller number of semesters which shall be prescribed for him at the time of his admission to the programme.

AR(PG) 19.3 The CPI of such a student will be calculated on the basis of only the courses taken at this Institute.

AR(PG) 20 REQUIREMNTS FOR THE AWARD OF M. Tech. DEGREE

AR(PG) 20.1 To be eligible for the award of the degree of Master of Technology a student must earn a total of at least **115** credits as prescribed under his programme of studies with

i) A minimum CPI of 5.00 and
ii) No course with letter grade FF or LA at any level.

AR(PG) 20.2 The total credits requirements for the degree of M. Tech must be completed in not more than 8 semesters from the date of admission.

AR(PG) 20.3 For a student admitted by transfer the maximum permissible duration shall be 50 percent more than the period prescribed for completion of his programme at the time of his admission.

AR(PG) 20.4 If the Academic Council is satisfied that there are extenuating circumstances, the student may be allowed a maximum of 2 additional semesters to complete his degree requirements.

AR(PG) 21 AWARD OF CLASS

AR(PG) 21.1 The class awarded to a student with his M. Tech. degree is decided by his final CPI as per the following table :

FIRST CLASS WITH DISTICTION	- CPI not less than 7.25
FIRST CLASS	- CPI less than 7.25 but not less than 6.50
SECOND CLASS	- CPI less than 6.50 but not less than 5.75
PASS CLASS	- CPI less than 5.75 but not less than 5.00

CPI less than 5.00 is not eligible for award of degree

A candidate who passes in all subjects and all heads of passing in the examination shall be given a gracing of the required CPI for getting second class/ first class/ first class with distinction, subject to a maximum of CPI 0.10, in concurrence with rules and guidelines of AICTE/ GTU.

AR(PG) 22 TRANSCRIPT

AR(PG) 22.1 The Transcript issued to the student at the time of leaving the University will contain a consolidated record of the entire course taken by him, grades obtained, SPI, CPI, etc.

AR(PG) 23 EXAMINERS

AR(PG) 23.1 The respective board of studies shall appoint at least two examiners for end semester theory as well as practical/viva examination. For each end semester theory examination, there shall be two paper setters. One paper setter out the two shall be from outside the institute (external examiner). The end semester theory and practical examination of each subject shall be conducted by an internal and an external examiner. The internal examiner shall be appointed as convener who shall co-ordinate the examination procedure for end semester examinations of the respective subject.

AR(PG) 24 RE-ASSESSMENT

AR(PG) 24.1 A student shall apply for re-assessment of his/ her answer books of end semester examination (theory) only within seven working days after the declaration of the results.

AR(PG) 24.2 The board of studies shall appoint **two examiners (one is Convener of original exam and other is new examiner)** for the reassessment of the end semester examination (theory) for both sections. **Both examiners shall jointly reassess both the sections.**

AR(PG) 24.3 The marks obtained by the candidate shall be considered for grading after re-assessment, only if, the change in mark is more than or equal to 10% of total mark of End Semester **(Theory)** Examination.

AR(PG) 25 GRADING

AR(PG) 25.1 The office of the Controller of Examination shall prepare the histogram of each subject for the purpose of grading after the completion of assessment of the subject. The histogram for dissertations shall not be prepared and each dissertation shall be graded individually as per the guidelines given from time to time.

AR(PG) 25.2 The convener of the respective subject shall grade the students based on the histogram provided by the Controller of Examination.

AR(PG) 26 GRADE REVIEW

AR(PG) 26.1 The Academic Council shall appoint Grade Review Committee for each semester. The Grade Review Committee shall constitute following members.

(a) Principal
(b) All Board of Studies Chairman
(c) University Nominee
(d) Dean, Academics
(e) Associate Dean, Academics
(f) Controller of Examination
(g) Member Secretary, Academic Council
(h) Office-in-charge of Credit System

AR(PG) 26.2 The Grade Review Committee shall meet immediately after results of all courses are completed and review the grades awarded by the convener of respective subject. The revision of the grade suggested by the Grade Review committee shall be considered as final grade and binding.

AR(PG) 27 DISSERTATION EVALUATION

AR(PG) 27.1 The student shall present his/her progress during the dissertation phase for at least two times in a semester as a part of continuous evaluation. The presentation shall be evaluated by the Dissertation Progress Committee (DPC). The DPC comprises at least two faculty members from the department of same area/field and the guide. The convener of the DPC shall be other than guide of the student.

AR(PG) 27.2 At the end of each semester, the dissertation shall be evaluated by the guide (internal examiner) and external examiner.

AR(PG) 27.3 Marks Distribution for a Dissertation in a semester shall be as follows.

Continuous Evaluation (CE)	**End Semester Examination (ESE)**
40 Marks	60 Marks
Evaluated in two presentations by DPC as per AR (PG) 27.1, each evaluator has equal weightage in assessment.	Evaluated in the presentation made by the student at the end of semester by internal examiner/s and external examiner/s. Internal examiner/s shall award 50% of ESE marks and external examiner/s shall award 50% of ESE mark.

AR(PG) 27.4 As partial fulfilment of the dissertation, the student shall present/publish at least one paper in conference/journal.

AR(PG) 27.5 The student shall submit the plagiarism report for his/her thesis. The thesis with less than 20% plagiarism shall be accepted for the End Semester Presentation. The plagiarism instruction shall be issued from time to time.

AR(PG) 27.6 No exemption/relaxation in the course work of 3rd and 4th semester shall be permitted during the dissertation period of the PG student.

Annexure – I: Programme of studies leading to the degree of the Master of Technology (Construction Engineering & Management)

Semester I

SR. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CM501	Construction Project Management	4	2	0	6
2.	CM502	Advance Construction Techniques	4	2	0	6
3.	CM503	Advanced Civil Engineering Materials	3	0	2	5
4.	MA501	Probability and Statistics	3	2	0	5
5.		**Program Elective I**	3	2	0	5
		TOTAL	**17**	**8**	**2**	**27**
		Program Elective I, Semester I				
5A.	CM551	Construction Finance and Accounting	3	2	0	5
5B.	CM552	Sustainable Smart Buildings	3	2	0	5

Semester II

SR. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CE541	Research Methodology in Civil Engineering	1	0	2	3
2.	CM504	Resource Management	4	2	0	6
3.	CM505	OR in Construction Management	4	2	0	6
4.	CM506	Construction Contract Management	3	2	0	5
5.	CM507	Infrastructure Project Management	3	2	0	5
6.		**Program Elective II**	3	0	2	5
		TOTAL	**18**	**8**	**4**	**30**
		Program Elective II, Semester II				
6A.	CE551	GIS and GPS in Civil Engineering	3	0	2	5
6B.	CM553	Project Risk Analysis and Mitigation Techniques	3	2	0	5

Semester III

SR. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CM601	Seminar	0	2	0	2
2.	CM611	Dissertation - I	0	0	18	18
3.		**Program Elective III**	3	0	2	5
4.		**Open Elective**	3	2	0	5
		TOTAL	**6**	**4**	**20**	**30**
		Program Elective III, Semester III				
3A.	CM651	Value Engineering	3	2	0	5
3B.	CM652	Sustainable Construction	3	2	0	5
		Open Elective, Semester III				
4A.	CM681	Strategic Management	3	2	0	5
4B.	CM682	Disaster Management	3	2	0	5

Semester IV

SR. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CM602	Seminar	2	0	0	2
2.	CM612	Dissertation - II	0	0	23	23
3.		**Program Elective IV**	3	2	0	5
		TOTAL	**5**	**5**	**20**	**30**
		Program Elective IV, Semester IV				
3A.	CM653	Management Information Systems	3	2	0	5
3B.	CM654	Maintenance Management of Construction Project	3	2	0	5

Annexure –II: Syllabi for the courses offered in programme of studies leading to the degree of Master of Technology (Construction Engineering & Management)

CM501: CONSTRUCTION PROJECT MANAGEMENT
CREDITS = 6 (L=4, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
4	2	0	6	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Project Management Basic Concept:** Introduction. Over view of Construction Project & Project Management. Indian Construction industry and their problems of Cost overruns & Time overruns. Phases of construction project and life cycle of project. Project Appraisal & Cost-benefit analysis. Detailed Project Report (DPR), Project Maturity, Success and Failures. Concepts of BOT, BOLT, BOOT etc.	06
2	**Project Organizations:** Introduction. Formal and informal organization. Forms of Project organizations. Requirements of a project organization. Types and selection of organizations.	06
3	**Project Planning, Scheduling and Control Management:** Introduction. WBS: Necessity, Methodology and Types. Project planning and scheduling techniques: CPM, PERT & GERT, LOB & LADDER Networks, Precedence Networks, Critical Chain Network. Time & Resource Planning. Management Software.	16
4	**Construction Safety Management:** Evolution of safety, Accident causation theories, Foundation of major injury, Health & Safety Act & Regulations, Cost of accidents, Roles of safety personnel, Investigations and Prevention Of Accidents, Nature, Causes And Control Measures, Principles of safety, Hazard Identifications and Control Techniques, Safety and health management system. Research results in safety management.	08
5	**Project Quality Control:** Introduction. Construction Quality Control: QA-QC Model, Quality Assurance: TQM, ISO Standards, CONQUAS and AUDIT. Cost of Quality. Quality policy, Objectives and methods in construction industry, Factors Influencing Construction Quality, Construction Productivity.	08
	Total	**44**

List of References:

1. J.D. Weist and F.K. Levy, "*A Management Guide to PERT/CPM*", Prentice Halls of India Pvt. Ltd.
2. Parammeshwar P. Iyer, "*Engineering Project Management Wheeler Publishing*", New Delhi.
3. K. K. Chitkara, "*Construction Project Management*", Tata McGraw-Hill, New Delhi.
4. P. K. Joy, "*Total Project Management*" Macmillan India Ltd, New Delhi.
5. Kumar Neeraj Jha, "*Construction Project Management*" Pearson, New Delhi.
6. George J. Ritz, "*Total Construction Project Management*" McGraw-Hill, New York.
7. J.D. Stevens, "*Planning Techniques for Construction Network Scheduling*", McGraw.
8. Dr. S. Seetharaman, "*Construction Engineering & Management*", Umesh Publications, Delhi.
9. Gupta Rajiv, "*Construction Planning and Technology*", CBS Publication, Delhi.
10. Pandey S.K., "*Fundamentals Network Analysis & Synthesis*", S.Chand Publication, Delhi.

CM502: ADVANCED CONSTRUCTION TECHNIQUES
CREDITS = 6 (L=4, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
4	2	0	6	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	Introduction to Advanced Construction Techniques.	02
2	Construction Techniques for Excavations, Dewatering of Excavations, Pile Foundations and Piling Techniques, Caissons, Box Jacking, Pipe Jacking, Construction of Coffer Dams. Trenchless Technology. Construction for High Rise Structures, Buildings, Chimneys, Cooling Towers.	12
3	Construction Techniques of Special Structures: Lattice Towers and Transmission Line Structures, On Shore and Off Shore Structures, Geodesic Structures. Tunnels, Bridges, Roads.	12
4	Temporary Structures for new and damaged structures, Advance Demolition and Dismantling Techniques. Retrofitting, Strengthening of Various R.C.C Structures, Strengthening of Masonry Structures.	08
5	Precast and Pre Stressing Techniques. Modular Coordination: Basics of Modular Co-Ordination, Advantages of Modular Coordination, applications of Modular Coordination. Erection Technology: Erection Cycle, Erection Methods for Various Types of Buildings And Steel Structures.	10
	Total	**44**

List of References:

1. S.S. Ataev, "*Construction Technology*", Mir Publishers.
2. P. Dyanchenko and S. Mirotvorsky, "*Prefabrication of Reinforced Concrete*", Mir Publishers.
3. Henrick Nissen, "*Industrial Building and Modular Design*", Cement Concrete Association, London.
4. R. Chudlay, "*Construction Technology (Vol. I to IV)*", Longman.
5. Robert wade Brown, "*Practical foundation engineering hand book*", McGraw Hill Publications.
6. Patrick Powers, and J. John, "*Construction Dewatering: New Methods and Applications*", Wiley & Sons.
7. Roy Chudley and Roger Greeno, "*Advanced Construction Techniques*", Pearson Prentice Hall.
8. Peurifoy, "*Construction Planning, Equipment & Method*", Tata McGraw Hall Pub.
9. Sanksar S and Saraswati S., "*Construction Technology*", Oxford University Press.
10. M.S. Shetty, "*Concrete Technology: Theory and Practice*", S.Chand Pub. 5.

CM503: ADVANCED CIVIL ENGINEERING MATERIALS
CREDITS = 5 (L=3, T=0, P=2)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	Introduction, Durability, Mechanical Properties, Deformational Behavior, Thermo Physical Properties Etc.	03
2	Classification, Specification, Properties, Tests As Per IS For Various Civil Engineering Materials.	06
3	Walling Units, Binding Materials And Additives, Aggregates, Gypsum Products, Wood Base Products, Ferrous And Non-Ferrous Metal Products, Various Types Of Concretes And Concrete Additives And Admixtures.	12
4	Repair Materials, Adhesives And Sealants.	06
5	Recent Developments And Market Awareness Regarding Applications, Varieties, Sizes And Specification For Various Materials.	09
	Total	**36**

List of References:

1. D.N. Ghose, "*Materials of Construction*", Tata Mc Graw Hill.
2. Jackson N. Ed., "*Civil Engineering Materials*", ELBS, London.
3. S.Z. Haider, "*Material of Construction*", Oxford Unviersity Press.
4. BRE Digest, "*Building Materials*", the Construction Press, London.
5. CBRI, "*Building Materials and Components*", Tata Mc Graw Hill.

CM551: CONSTRUCTION FINANCE AND ACCOUNTING
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Basic financial concepts:** Capital and Revenue, financial accounting, cost accounting, management accounting, financial management.	03
2	**Accounting Process:** GAPP, double entry system, ten point book keeping system, journal, ledger, cash book, trial balance, final account, provision and reserves, depreciation accounting, preparation of profit and loss account and balance sheet as per companies act, 1956, interpretation of financial statements.	06
3	**Project Accounts:** Methods of recording and reporting site accounts to project office and from project office to head office.	06
4	**Financial Management:** Financial statement analysis, ratio analysis, fund flow, cash flow analysis, source of finance. Estimating working capital needs and factors affecting it, financing working capital needs, sources, procedures and practice in construction industry, break even analysis.	06
5	Corporate taxing and tax planning, joint ventures, financial packaging of project.	06
6	**Project Cost Management:** Introduction. Cost Planning, Cost Budgeting and Cost Control. Estimation of project cost. Cost appraisal of project. Project cash-flow analysis and planning. Value engineering in cost validation.	06
	Total	**33**

List of References:

1. Bhattacharya S.K. and John Dearden, "Accounting for Management" Vani Educational Books, Bombay.
2. Mott C.H., "Accounting and Finance Management for Construction Vol. I", John Wiley, New York.
3. EPPS B.G. and Whiteman D.E. , "Cost Accounting for Construction Firms", John Wiley, New York.
4. Corniman D., "Construction Management: Planning & Finance", Construction Press, London.

CM552: SUSTAINABLE SMART BUILDINGS
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	Basics of sustainability, Benefits of Sustainable Building, Sustainable Building Design, Site Location and Selection, Reducing Material Impacts, Increasing Energy Efficiency and Comfort, Building Systems that Reduce Material and Energy Impacts: Sustainable Foundations, Sustainable walling units, Sustainable Floor Framing Systems, Sustainable Roofing Systems, Sustainable Exterior and Interior Finish Materials, Sustainable Building Checklist.	09
2	Introduction to smart buildings and structures - Instrumented Structures Functions and Response -Sensing systems - Self-diagnosis - Signal processing consideration - Actuation systems and effectors.	06
3	Sensing Technology - Types of Sensors - Physical Measurement using Piezo Electric Strain, measurement - Inductively Read Transducers - The LVOT - Fiber Optic Techniques. Chemical and Bio-Chemical sensing in Structural Assessment - Absorptive chemical sensors -Spectroscopes - Fibre Optic Chemical Sensing Systems and Distributed measurement.	06
4	Measuring Techniques - Strain Measuring Techniques using Electrical strain gauges, Types -Resistance - Capacitance - Inductance - Wheatstone bridges - Pressure transducers - Load cells -Temperature Compensation - Strain Rosettes.	06
5	Actuator Techniques - Actuator and actuator materials - Piezoelectric and Electrostrictive Material - Magneto structure Material - Shape Memory Alloys - Electro rheological Fluids- Electromagnetic actuation - Role of actuators and Actuator Materials.	06
	Total	**33**

List of References:

1. Brain Culshaw, "*Smart Structure and Materials*", Artech House - Borton. London-1996.
2. Srinivasan A.V and Michael McFarland. D, "*Smart Structures - Analysis and Design*", Cambridge University Press, 2001.
3. L. S. Srinath, "*Experimental Stress Analysis*", Tata McGraw-Hill, 1998.
4. J. W. Dally and W. F. Riley, "*Experimental Stress Analysis*", Tata McGraw-Hill, 1998.
5. Mukesh V. Gandhi and Brian S. Thompson, "*Smart Materials and Structures*", Springer, May-1992.

MA501: PROBABILITY AND STATISTICS
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	Preparation and standardization of data; measure of dispersion moments, skewness and kurtosis; Basic concept of probability; Independent & Dependent events. Mutually exclusive events Additions & Multiplication theorems, conditional probability and Bayes formula.	09
2	Random variables; discrete and continuous probability distribution; joint probability distribution; Laws of Expectation.	09
3	Main feature of Binominal, Poisson & Normal distributions and their properties, applications in engineering and industrial problems; Exponential, Rayleigh, Weibull, Gamma, Pearson, and log-normal distributions; transformation of random variables, moment generating functions.	09
4	Concepts of stochastic process, processes with independent; Process Furry Yale process, Pol ya process. Homogeneous macro chains analysis; Correlation and Regression, Multiple, partial and Rank Correlation, Analysis of Time Series data.	09
5	Element of sampling theory; large and small samples, fiducial limits for unknown mean standard error; test of significance, T & F test. Introduction to theory of estimation; simple analysis of variants of one and two way classification.	09
	Total Hrs.	**45**

List of References:

1. Hoel P.G., "*Introduction to Mathematical Statistics".*
2. Fisz M., "*Probability and Mathematical Statistics".*
3. Alder H.L, "*Introduction to Probability and Statistics".*
4. Walpole R.E., Mayers R.H., "*Probability and Statistics for Engineers and Scientist".*
5. Montogomery and Runger GC., "*Applied statistics and probability for Engineer",* student edition, Wiley.

CE541: RESEARCH METHODOLOGY IN CIVIL ENGINEERING
CREDITS = 3 (L=1, T=0, P=2)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
1	0	2	3	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	Introduction to research methodology.	01
2	Importance of research in decision Making.	01
3	Defining research problem and formulation of research problem.	02
4	Research designs: Exploratory, Descriptive, And Experimental.	02
5	Data collection and measurement:-Methods and techniques of data collection: Primary data through communication, Designing Questionnaire, Qualitative Research, sampling and sampling designs Attitude measurement and scales.	03
6	Data presentation and analysis: Data processing, Univariate and Bivariate analysis, Correlational analysis ANOVA, Analysis of Associations, Multivariate analysis and data, Model building and decision making.	05
7	Report Writing and presentation: Content of reports, formatting of content, and presentation of reports.	01
	Total	**15**

List of References:

1 C.R. Kothari. *"Research Methodology - Methods and Techniques"*, 2nd Edition, New Delhi, New Age International (P) Limited, 2003.
2 Eileen M. Trauth. *"Qualitative Research in IS: Issues & Trends",* USA/London: IDEA Group Publishing, 2001. (ISBN: 1-930708-06-08).

CM504: RESOURCES MANAGEMENT
CREDITS = 6 (L=4, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
4	2	0	6	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Material Management:** Materials & their peculiarities, Systems of material classification, Material reconciliation. Importance and objectives of material management. Functions of material management: Material planning, materials codification and standardization, Material procurement process, Custody (receiving, warehousing and issuing) of material, material accounting, transportation, Wastage audit at site, Site waste material management plan. Inventory related costs, functions of inventory, inventory policies. Selective inventory control: ABC analysis, VED analysis etc. Inventory models: deterministic and probabilistic models and applications, Computer applications based upon available software's.	16
2	**Equipment management :** Classification and operational characteristics and production rates of various equipment. New trends and construction equipment of future. Planning and selection of equipment for earthmoving, hauling, hoisting, conveying, pneumatic, pumping, aggregate production, concrete production, pile driving, tunneling and road construction applications. Equipment procurement, purchase, import of equipment, procedural formalities for import. Planning and maintenance of equipment, Replacement policies. Depreciation and taxation, depreciation methods. Safety aspects on construction equipment. Advanced concepts: sensitivity analysis, break even analysis.	16
3	Basics of personnel management, manpower planning, labour laws and industrial relations. Role of personnel management in construction companies. Personnel management: concepts, definitions, new developments in HRD and HRM. Man power estimations for project, methods of man power estimations at various stages. Methods of selection, training, placement, financial comparisons, discipline, in employing and retaining engineers and managers. Role, function, relationships with other departments, office record keeping and procedures. Legal aspects: labour legislation, labour laws, grievance handling, enquiry procedure, labour administration and judiciary in relation to construction industry.	12
	Total	**44**

List of References:

1. Mahesh Varma,"*Construction Planning and Management through Systems Techniques*" Metropolitan Books Co. Pvt. Ltd.
2. Kwaku A. Tenah and Jose M. Guevara, "*Fundamentals of Construction Management and Organization*" Reston Publishing Co. Inc.
3. Dr. S. Seetharaman, "*Construction Engineering & Management*" Umesh Publications.

4. R.L. Peurity and W.B.Ledbetter, "*Construction Planning, Equipments & Methods*",Mc Graw Hill.
5. K.A. Tenah and J.M. Guevara, "*Fundamentals of Construction Management & Organization*" Reston Publishing Co.
6. Dr. Mahesh Verma, "*Construction Equipments and its Planning & Applications*" Metropolitan Publishing Co.
7. S.C. Khanna, "*Construction Equipment & Management*", Khanna Publishers.
8. A.K. Datta, "*Materials Management: Procedures, Text and Cases*", PHI Learning Pvt. Ltd., 2004.
9. Arnold, "*Introduction to Materials Management*", Pearson Education India, 2009.
10. Richard J. Tersine, "*Principles of Inventory and Materials Management*", Prentice Hall, 1994.
11. Richard J. Tersine, "*Modern Materials Management*", John Hardin Campbell – 1977.
12. P. Gopalakrishnan, "*Handbook of Materials Management*", PHI Learning Pvt. Ltd.2004.
13. Monappa A. and M.S. Saiyadaiu, "*Personnel Management*" Tata Mc Graw Hill.
14. Vaid K.N., "*Labour Laws for the Construction Industry in India*" NICMAR, Bombay.
15. Miuer J.B. and Miuer M.G., "*Personnel and Industrial Relations*", A Management Approach Mc. Millan, New York.
16. Shah Vinita, "*Human Resource Development in Construction Industry*" NICMAR, Bombay.
17. Carleton Counter II and Jill Justice Coulter, "*The Complete Standard Hand Book of Construction Personnel Management*", Prentice Hall, Inc., New Jersey, 1989.
18. Memoria, C.B., "*Personnel Management*", Himalaya Publishing Co., 1992.
19. Josy.J Familaro, "*Handbook of Human Resources Administration*", McGraw Hill International Edition, 1987.
20. Justin Gooderl Longenecker, Charles D. Pringle, "*Management*" C.E. Merrill, 1981.
21. R.S.Dwivedi, "*Human Relations and Organizational Behaviour* ", B.H - 1987.
22. Shamil Naoum, "*People and Organizational Management in Construction*", Thomas Telford, 2001.
23. Stephen Bach and Keith Sissons,"*A Comprehensive Guide to Theory and Practice*", John Wiley & Sons, 2000.
24. Andrew Dainty, Martin Loosemore, "*Human Resource Management in Construction Projects*", Routledge, 2012.

CM505: OR IN CONSTRUCTION MANAGEMENT
CREDITS = 6 (L=4, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
4	2	0	6	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Introduction:** Introduction to Operations Research: Basic definitions, scope, objectives,	08

Unit No.	Topics	Teaching Hrs.
	phases, models and limitations of Operations Research. Linear Programming Problem, Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method, two-phase method, degeneracy and unbound solutions.	
2	**Transportation Problem:** Transportation Problem. Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions," Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.	04
3	**Assignment problem:** Assignment model. Formulation. Hungarian method for optimal solution. Solving unbalanced problem.	03
4	**Decision Theory:** Decision strategies - decision under certainty - decision under risk - decision under uncertainty - formulation - decision criterion and decision under competitive situation. Decision tree.	06
5	**Dynamic Programming:** Dynamic programming. Characteristics of dynamic programming. Dynamic programming approach for Priority ,Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems	04
6.	**Game Theory:** Classification of games. Two - person, zero - sum games - formulation of pay off matrix - saddle points - games with pure strategies and mixed strategies - value of the game. Solution to 2 x 2 matrix, 2 x n matrix, m x 2 matrix and m x n pay- off matrix. Graphical method, algebraic method, linear programming methods. Guidelines to modeling an OR project.	05
7	**Waiting Line Theory:**	03
	Total	**33**

List of References:

1. Richard Bronson, "*Theory & Problem of Operations Research*" Schaum's Outline Series - Mc Graw Hill Book Co., 1983.
2. Hamdy A. Taha, "*Operations Research*" An Introduction Maxwell Macmillan International Edition - IV Edition – 1989.
3. G.V. Shenoy, U.K. Srivastav and S.C. Sharma, "*Operations Research for Management*" Wiley Eastern Limited, 1988.
4. M.P. Gupta and J.K. Sharma, "*Operations Research for Management"* National Publishing House 2nd Edition – 1987.
5. John O. Mcclain and Joseph Thomas, "*Operations Management*" Prentice Hall of India Private Limited, New Delhi, 1987.
6. R.C. Gupta, "*Quantitative Methods and Operations Research*" CBS Management Series, 1986.
7. Vohra N.D., "*Quantitative Techniques in Management*" Tata McGraw Hill.
8. Rea's Problem Solver, "*Operation Research*" Research & Education Association Publication.

CM506: CONSTRUCTION CONTRACTS MANAGEMENT
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Introduction to Law:** Introduction to law, Laws governing structure & Working of Construction Firms.	03
2	**Contracts Outline:** Contracts, types of construction contracts, Evaluation of contract documents, need for documents, present stage of national and international contract documents, roles and functions of participants to the contract.	06
3	**Tendering Process:** Preparation of tender documents estimating, pre-qualification, bid evaluation, award of contract, project financing and contract payments, contracts close out and completion, E-tendering.	06
4	**Contract Conditions:** Clarification by parties to contract, obligations and responsibilities of the parties, protection and indemnification, bonds and insurance, subsurface conditions, inspection of work, change of work, rejected work and deficiencies.	06
5	**Arbitration:** Causes and resolution of disputes, settlement for claims and extra items, arbitration. Comparison Laws-Agreements, Appointment of Arbitrators, Conditions of Arbitrations, Powers and duties of Arbitrator, Enforcement of Award-costs, Arbitration Act old & new.	09
6	**Specifications:** Definitions, relationship with drawings, necessity/purpose, advantages/ benefits, organization of specification, drafting/writing the specifications, types of specifications.	06
7	**Administration Management:** Proper record keeping in contract administering, establishment of standard procedures, coordination between various agencies involved, providing data for interpretation of contract clauses, Special aspects of contract management.	06
	Total	**42**

List of References:

1. B.D. Virmani, B.T.Gajaria, Mulla and Sanjeeva Rao, "*Explanation of Indian Contract Act*", Handbook of Contracts: Hudson.

2. Clough Richarch and John Wiley & Sons, "*Construction Contracting*", New York, 1986.
3. Prakash V.A., "*Construction Contract Management*", NiCmAR, Bombay.
4. B.N. Dutta, "*Estimating and Costing in Civil Engineering*" Theory and Practice UBS publishers, distributer's private limited.
5. Gajaria G.T., "*Laws Relating to Building and Engineering Contracts in India*", M.M.Tripathi Private Ltd., Bombay, 1982.
6. Jimmie Hinze, "*Construction Contracts*", McGraw Hill, 2001.
7. Joseph T. Bockrath, "*Contracts and the Legal Environment for Engineers and Architects*", McGraw Hill, 2000.

CM507: INFRASTRUCTURE PROJECT MANAGEMENT
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Introduction:** Definition of infrastructure, characteristics of infrastructure projects, scope of infrastructure management. Infrastructure in India: An Overview of the Power Sector in India. Water Supply and Sanitation Sector. The Road, Rail, Air and Port Transportation Sectors. Telecommunications Sector. The Urban Infrastructure, The Rural Infrastructure, An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure. The Stages of an Infrastructure Project Lifecycle. An Overview of Infrastructure Project Finance.	10
2	**Privatization of Infrastructures:** A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization. Problems with Infrastructure Privatization. Challenges in Privatization of Infrastructure. Privatization of Infrastructures in India. Introduction to infrastructure development through PPP route; Benefits of PPP mode of procurement; Types of PPP Models and their contractual structure, Stakeholders' perspectives: Granting authority, Funders and	10

Unit No.	Topics	Teaching Hrs.
	Concessionaire, Government's role in successful PPP projects, Financial and Economic Appraisal of BOT Projects; VFM evaluation, PPP procurement process; Lifecycle of PPP projects, Contractual package of PPP project; Bankable concession agreement, Case study – Procurement process of Indian PPP projects.	
3	**Challenges to Successful Infrastructure Planning and Implementation:** Mapping and Facing the Landscape of Risks in Infrastructure Projects. Economic and Demand Risks. Political Risks. Socio-Environmental Risks. Cultural Risks in Infrastructure Projects. Legal and Contractual Issues in Infrastructure. Challenges in Construction and Maintenance of Infrastructure. Introduction to risk management concept, Risk analysis techniques, Risk mitigation strategies.	10
4	**Strategies for Successful Infrastructure Project Implementation:** Shaping the Planning Phase of Infrastructure Projects to mitigate risks. Designing Sustainable Contracts. Introduction to Fair Process and Negotiation. Negotiating with multiple Stakeholders on Infrastructure Projects. 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. An Integrated Framework for Successful Infrastructure Planning and Management.	10
	Total	**40**

List of References:

1. Akintoye, A., Beck. M., and Hardcastle, C. (Eds.). (2003). Public-Private Partnerships "*Managing risks and opportunities*". Oxford: Blackwell Science Limited.
2. Alvin Goodman, Makarand Hastak, Infrastructure Planning Handbook: Planning, "*Engineering and Economics*" 1st Edition, MH/ASCE press.
3. Raghuram G (2001) "*Infrasturcture Development and Finnancing*" Towards A Public Private Partenership, Macmillan Publishers, New Delhi
4. Alagiri, "*Infrastructure Development*", ICFAI University press, Hydrabad
5. Marcel Hertogh, Stuart Baker, Pau Lian Staal-Ong and Eddy Westerveld, Managing Large.
6. Infrastructure Projects, ISBN/EAN 978-90-810025-2-3, NUR-code 801.
7. Finnerty, J. D. (1996). Project financing - Asset-based financial engineering. New York: John Wiley & Sons, Inc.
8. Merna, T., and Njiru, C. (2002). "*Financing infrastructure projects*" (First ed.). London: Thomas Telford.
9. Nevitt P. K., and Fabozzi F. J. (2000). "*Project financing*" (7 Ed.). London, UK: Euromoney

Books.
10. Raghuram, G., Jain, R., Sinha, S., Pangotra, P., and Morris, S. (2000). "*Infrastructure Development and Financing*" Towards a Public-Private Partnership: MacMillan.
11. Tinsley, R. (2002). "*Project Finance in Asia Pacific*" Practical Case Studies. London, UK: Euromoney Books.
12. UNIDO. (1996). Guidelines for infrastructure development through Build-Operate- Transfer (BOT) projects. Vienna: UNIDO.
13. Walker, C., and Smith, A. J. (1995). "*Privatized infrastructure*" the Build Operate Transfer approach. London: Thomas Telford.
14. Yescombe, E. R. (2002). "*Principles of Project Finance*" California: Academic Press.
15. Kurowski, L., and Sussman, D. (2011). "*Investment project design*" - A guide to financial and economic analysis with constraints. New Jersey: John Wiley & Sons.
16. Pretorius, F., Lejot, P., McInnis, A., Arner, D., and Hsu, B. F.-C. (2008). "*Project finance for construction and infrastructure*" Principles and case studies. Oxford: Blackwell Publishing.
17. Weber, B., and Alfen, H. W. (2010). "*Infrastructure as an asset class - Investment strategies*", project finance and PPP. West Sussex: John Wiley & Sons.

CE551: GIS AND GPS IN CIVIL ENGINEERING
CREDITS = 5 (L=3, T=0, P=2)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Introduction:** Geographical Concepts and Terminology, Difference between Image Processing System and Geographic Information System (GIS), utility of GIS, various GIS packages and their salient features, Essential components of a GIS.	06
2	**Data Acquisition:** Scanners and Digitizers, Method of Digitization, Raster and Vector Data, Data Storage, Verification and Edition. Data Preprocessing; Format Conversion, Data Compression, Data Reduction and Generalization, Run Length Coding, Merging, Edge Matching, Rectification and Registration, Interpolation.	06
3	**Data Base Structure:** Hierarchical Data, Network Systems. Relation Database. Data Management - Conventional Database Management Systems, Spatial Database Management.	06
4	**Data Manipulation and Analysis:** Reclassification and Aggregation, geometric and Spatial Operations on Data Measurement and Statistical Modeling. Data Output – Types of Output. Application of GIS in various Natural Resources Mapping &	12

Unit No.	Topics	Teaching Hrs.
	Monitoring, Engineering Application.	
5	Introduction to Global Navigation Satellite System, Introduction to GPS, GPS Segments: Space, Control and User segments. GPS principles, receiver types and positioning techniques. GPS applications in Transportation Engineering: Intelligent Transport System, Mass transport system and location based services. GPS applications in Construction Management: Location based material and equipment management.	12
	Total Hrs.	**42**

List of References:

1. P.A. Borough, "*Principles of Geographic information Systems for Land Resources Assessment*", Oxford University Press, 1986.
2. Manual of Remote Sensing Vol. 2, American Society of Photogrammetry and Remote Sensing.
3. Stan Aronoff, "*Geographic Information Systems: A Management Perspective*", WDL Publications, 1991.
4. Dr. Chandra A.M., "*Remote Sensing and GIS*", Narosa Publishers, New Delhi.
5. B. Bhatta, "*Remote Sensing and GIS*", Oxford University Press, New Delhi.

CM553: PROJECT RISK ANALYSIS AND MITIGATION TECHNIQUES
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**General:** Importance of Risk, types of risks, quantifiable and unquantified risks.	06
2	**Risk analysis and Management for projects (RAMP):** Identifying risk events. Probability distribution. Stages in Investment life-cycle; determination of NPV and its standard deviation for perfectly co-related, moderately co-related and un-correlated cash flows. Sensitivity analysis, scenario analysis simulation, decision tree analysis, risk profile	18

Unit No.	Topics	Teaching Hrs.
	method, certainly equivalent method; risk adjusted discount rate method, certainty index method, 3 point estimated method; use of risk prompts, use of Risk Assessment tables, details of RAMP process, utility of Grading of construction entities for reliable risk assessment.	
3	**Risk Mitigation Techniques:** Elimination, reducing, transferring, avoiding, absorbing or pooling. Residual risk, mitigation of unquantified risk. Coverage of risk through CIDC's MOU with the Actuarial Society of India through risk premium such as (BIP) - Bidding Indemnity Policy (DIMO) - Delay in meeting obligation by client policy, (SOC) - Settlement of claims policy (LOP)- Loss of profit policy (TI). Transit Insurance policy (LOPCE) Loss of performance of construction equipment policy.	18
	Total Hrs.	**42**

List of References:

1. Dr.Surendra Kumar Satya Prakashan, "*Industrial Engineering and Management of manufacturing systems*".
2. RAMP Handbook by institution of Civil Engineers and the faculty and Institute of Actuaries-Thomas Telford publishing, London.
3. Seetharaman, "*Construction Engineering and Management*"
4. Prasanna Chandra, "*Projects Planning analysis selection implementation and Review*".

CM651: VALUE ENGINEERING
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Introduction:** Concept and definition, objectives of Value engineering, Advantages of Value methodology, Scenario of value engineering with context to India, Origin of Value engineering. Quantity surveying and value engineering, team of value engineering and its quality, Applicability to Mega projects, Value engineering and project management.	06

Unit No.	Topics	Teaching Hrs.
2	**Value Analysis:** Concept, Job planning and its importance in value engineering, Various phases of Value Engineering -Information Phase, Function Analysis Phase, Creative Phase, Evaluation Phase , Development Phase.	09
3	**Functional Analysis:** Functions at various levels and of various types, cost and worth of function, importance of functional analysis, FAST Diagramming - How to prepare.	09
4	**Creative Phase:** Creative thinking and creative processes, Application in Value engineering, Various techniques, fundamental approaches of similarity, contiguity and contrast, Positive approach.	09
5	**Cost Model:** Introduction, Value, Cost and Worth, True and Poor value, Factors affecting the value , Value Index, Cost and Value Gap, importance of cost model in Value Engineering , Function and Matrix Cost model, Life cycle cost analysis.	06
6	Environmental Impact Assessment with VE approach for the projects.	03
	Total	**42**

List of References:

1. Larry W. Zimmerman, "*Value Engineering: A Practical Approach for Owners*", Designers & Contractors - CBS Publication.
2. Arthur E. Mudge, "*Value Engineering: A Systematic Approach*", Mc GrawHill.
3. Donald E. Parker, "*Value Engineering : Theory*", Soundaram Publishers
4. O' Brien J.J., "*Value Analysis in Design and Construction*", Mc Graw Hill.
5. "*Value Methodology*" A Pocket Guide to Reduce Cost and Improve Value Through Function Analysis; Lawrence D Miles Foundation.
6. Lomansh, S., "*Value Management: A Textbook*", 1997 - Sterling Publishers (Pvt.) Ltd., New Delhi.

CM652: SUSTAINABLE CONSTRUCTION
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Sustainable Planning:** Energy Efficient Shelters, Housing Options Today, Site Planning and Use	10

Unit No.	Topics	Teaching Hrs.
	of On-Site Resources, Smaller Houses that Utilize Space and Materials More Efficiently, Working With Nature, Balancing Energy and Aesthetic Needs.	
2	**Sustainable Materials:** Construction materials -locally available building materials- Soil, Fly ash, Ferro cement, Lime, Fibers, Stone Dust, Red mud, Gypsum, Alternate Wood, Polymer-ADOBE, Cob Rammed Earthlight Clay, Straw-Bale, Bamboo, Agro-Industrial Waste, Structural Properties Of Alternate Building Materials, Innovative Materials of CBRI.	10
3	**Cost Effective Construction Equipment's:** Equipment's-Brick moulding machine, Stabilized soil block making machine and plants for the manufacturing of concrete blocks, M.C.R. tile making machine, Ferro cement wall panel & Roofing channel making machine, R.C.C. Chaukhat making machine.	10
4	**Cost Effective Construction Techniques:** Construction Techniques-Innovative Techniques developed by CBRI, SERC for foundation, superstructure, roofing, pre- fabricated construction techniques, advantage of pre-fabrication areas where pre-fabrication can be introduced, modular contained earth, earth bag construction.	10
	Total	**40**

List of References:

1. Lynne, Cassandra Adams "*Alternative Construction: Contemporary Natural Building Methods*", Soft cover, Wiley & Sons Australia, Limited, John, 2005.
2. Eugene Eccli, "*Low Cost, Energy efficient shelter for owner & builder*", Rodale Press, 1976.
3. Givoni, "*Man, Climate, Architecture*", Van Nostrand, New York, 1976.
4. Charles J. Kibert, "*Sustainable Construction: Green Building Design and Delivery*", John Wiley & Sons, 2005.

CM681: STRATEGIC MANAGEMENT
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Strategy and Process:** Conceptual framework for Strategic Management, The Concept of Strategy	07

Unit No.	Topics	Teaching Hrs.
	and the Strategy Formation Process, Stakeholders in business, Vision, Mission and Purpose, Business definition, Objectives and Goals, Corporate Governance and Social responsibility, Case study.	
2	**Competitive Advantage:** External Environment, Porter's Five Forces Model, Strategic Groups Competitive Changes during Industry Evolution, Globalization and Industry Structure, National Context and Competitive advantage Resources, Capabilities and competencies, Core competencies, Low cost and differentiation Generic Building Blocks of Competitive Advantage, Distinctive Competencies, Resources and Capabilities durability of competitive Advantage, Avoiding failures and sustaining competitive advantage, Case study.	07
3	**Strategies:** The generic strategic alternatives, Stability, Expansion, Retrenchment and Combination strategies, Business level strategy, Strategy in the Global Environment, Corporate Strategy, Vertical Integration, Diversification and Strategic Alliances, Building and Restructuring the corporation, Strategic analysis and choice, Environmental Threat and Opportunity Profile (ETOP), Organizational Capability Profile, Strategic Advantage Profile, Corporate Portfolio Analysis , SWOT Analysis, GAP Analysis, Mc Kinsey's 7s Framework, GE 9 Cell Model, Distinctive competitiveness, Selection of matrix, Balance Score Card, case study.	07
4	**Strategy Implementation & Evaluation:** The implementation process, Resource allocation, Designing organizational structure, Designing Strategic Control Systems, Matching structure and control to strategy, Implementing Strategic change, Politics, Power and Conflict, Techniques of strategic evaluation & control, Case study.	07
5	**Other Strategic Issues:** Managing Technology and Innovation, Strategic issues for Non Profit organizations, New Business Models and strategies for Internet Economy, case study	07
6	**Alternate Strategic:** Alternate strategy, Joint sector, existing government policies with respect to PPP mode, case study.	07
	Total	**42**

List of References:

1. William F Glueck and L. R. Jauch, "*Business policy and strategy*", McGraw Hill.
2. Steiner G and J. Miner, "*Management policy and strategy*" Macmillan New York.
3. Dasgupta A. and Sen Guha, "*Government and Business in INDIA*", Allied publishers, Calcutta.
4. Mles r. and C Snow, "*Organization Strategy structure and processes*" McGraw Hill.

5. Hofer C. and D. Vencil, "*Strategic planning systems*" Englewood cliffs.
6. Neil Ritson and ventus, "Strategic Management", publishing.
7. G. Sudarsana Reddy and K. Aswathappa, "*Strategic Management concepts and cases*", Himalaya publishing house.
8. Srinivasan, "*Strategic Management: The Indian Context*", 3rd Ed, PHI learing pvt. Ltd.

CM682: DISASTER MANAGEMENT
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Objectives:** Overview of Disaster Management - Distinguishing between an emergency and a disaster situation. Disaster Management Cycle - Phase I: Mitigation, and strategies; hazard identification and vulnerability analysis. Disaster Mitigation and Infrastructure, impact of disasters on development programmes, vulnerabilities caused by development, developing a draft country-level disaster and development policy.	06
2	**Phases:** Disaster Management Cycle - Phase II: Preparedness, Disaster Risk Reduction (DRR), Emergency Operation Plan (EOP), Mainstreaming Child Protection and Gender in Emergency Planning, Assessment, Disaster Management Cycle - Phases III and IV: Response and recovery, Response aims, Response Activities, Modern and traditional responses to disasters, Disaster Recovery, and Plan , Disasters as opportunities for development initiatives.	12
3	**Disaster Community:** Community-based Initiatives in Disaster management, need for Community-Based Approach, categories of involved organizations: Government, Non-government organizations (NGOs), Regional And International Organizations, Panchayats, Community Workers, National And Local Disaster Managers, Policy Makers, Grass-Roots Workers, Methods Of Dissemination Of Information, Community- Based Action Plan, Advantages/Disadvantages Of The Community- Based Approach.	06
4	**Disaster Planning:** Disaster Response Personnel and duties, Community Mitigation Goals, Pre-Disaster Mitigation Plan, Personnel Training, Volunteer Assistance, School-based Programmes, Hazardous Materials, Ways of storing and safely handling hazardous materials, Coping with Exposure to Hazardous	09

Unit No.	Topics	Teaching Hrs.
	Materials.	
5	Applications of science and technology for disaster management Geo informatics in Disaster Management: RS, GIS, GPS Disaster safe design and construction. Structural and non-structural mitigation of disasters. S&I Institutions for Disaster Management in INDIA.	09
	Total	**42**

List of References:

1. Ayaz, "*Disaster Management: Through the New Millennium*", Anmol Publications. (2009).
2. Dave P.K. "*Emergency Medical Services and Disaster Management: A Holistic Approach*", New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2009.
3. Narayan B., "*Disaster Management*", New Delhi: A.P.H. Publishing Corporation, 2009.
4. Kumar N., "*Disaster Managemen*", New Delhi: Alfa Publications. , 2009.
5. Ghosh G. K., "*Disaster Management*", New Delhi: A.P.H Publishing Corporation. , 2008.
6. Goel, S. L., "*Disaster Management*" New Delhi: Deep & Deep Publication Pvt. Ltd., 2008.
7. Singh R. B., "*Disaster Management*", New Delhi: Rawat Publications., 2008.
8. Seetharaman, "*Construction Engineering and Management*", Umesh Publications.
9. CE&CR's Journals.
10. NICMAR Publications.

CM653: MANAGEMENT INFORMATION SYSTEMS
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	**Management:** Definition, functions, levels, role of different levels of management in planning, decision making and control.	02
2	**Information:** Definition, Attributes and Value of information, Types of decision and value of information, Age of information.	08
3	**System:** Definition, Description, Types of systems, Decoupling and Control of Systems, Stress in systems.	08

Unit No.	Topics	Teaching Hrs.
4	**MIS:** Definition, Characteristics, Problems, Classification.	08
5	**Computer hardware and software for MIS, Database, DBMS. MIS in practice:** Transaction processing systems, Information reporting systems, Decision support systems, Expert systems and Office automatic systems.	08
6	**Project Planning, Analysis and Design of MIS:** MIS as system, Software development life cycles, Feasibility study, Requirement analysis, Data flow diagram and data dictionary, Process description. Software requirement specifications, Systems design, Structures Charts, Input-output design Development - testing, implementation and maintenance of MIS.	08
	Total	**42**

List of References:

1. Kanter J., "*Management Information Systems*" Prentice Hall of India.
2. V. Rajaraman, "*Analysis and Design of Information Systems*", Prentice Hall of India.
3. S.C. Bhatnagar and K.V. Ramani, "*Computers and Information Management*", Prentice Hall of India.
4. Mardick R.G. and Others, "*Information Systems for Modern Management*", Prentice Hall of India.
5. Gordan Davis B., "*Management Information Systems, conceptually foundation, Structure and Development*", McGraw Hill Book Company, International Edition, 1989.
6. Arora Asok and Bhatia Akshaya, "*Information Systems for managers*", Excel Books, New Delhi, 1999.
7. Sadgopan S., "*Management Information Systems*", Prentice Hall India Ltd., New Delhi, 1998.

CM654: MAINTENANCE MANAGEMENT OF CONSTRUCTION PROJECTS
CREDITS = 5 (L=3, T=2, P=0)

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Content:

Unit No.	Topics	Teaching Hrs.
1	Introduction to maintenance. Typical Maintenance Engineer's Duties, Functions and Responsibilities. Deteriorations: Structural Deficiency, External Forces, Internal Forces,	09

Unit No.	Topics	Teaching Hrs.
	Problems of Substructures, Materials Deficiency, Dimensional Instability, Thermal Movements, Finishing, Coatings, Vandalism etc.	
2	Definitions, Objectives of maintenance. Importance of maintenance, Types of maintenance: Unplanned Maintenance: Break Down Maintenance, Planned Maintenance: Preventive Maintenance, Predictive Maintenance, and Reliability Centered Maintenance.	12
3	Maintenance Management, Objectives of Maintenance Management, Types of Maintenance Management. Maintenance Dimension, Maintenance Organization, Nature of Maintenance Work, Condition Assessment Procedure, Maintenance Planning and scheduling, Estimation of Maintenance, Maintenance Contracts, Execution of Maintenance.	09
4	Maintenance Management System. Computerized Management System.	06
	Maintenance management and Maintenance Management System for Buildings and other Construction Projects based on Condition, Safety, Optimization and Life cycle cost.	06
	Total	**42**

List of References:

1. Dhillon and Balbir S. "*Maintainability, Maintenance, and Reliability for Engineers*", 2006.
2. CRC Press, ISBN 0-8493-7243-7, ISBN 978-0-8493-7243-8. , 2006.
3. Mobley, Keith R. and Higgins, Lindley R. & Wikoff, Darrin J. (2008) Maintenance, "*Engineering Handbook*", McGraw-Hill Professional, Seventh Edition, 2008, ISBN 0-07-154646-4, ISBN 978-0-07-154646-1.
4. Dip. Surv. Dip. Arch. Cons. FRICS FBEng. FRSA, Barrie Chanter, Peter Swallow, "*Building Maintenance Management*", Blackwell Publishing.
5. A.C. Panchdhari, Maintenance of buildings, New Age International, 1997, ISBN: 81- 224-1012-X.
6. John D. Szwedo, Preventive, Predictive and Corrective Maintenance, "*Code of Practice on Building Management & Maintenance*"
7. Maintenance Management System Handbook, 2002.
8. O & M Best Practices Guide, Release 3.0.
9. Charles E. Ebeling, "*An Introduction to Reliability and Maintainability Engineering*" McGraw Hill College Division 1996.
10. Richard D. (Doc) Palmer, "*Maintenance Planning and Scheduling Handbook*", McGraw Hill, 1999.
11. Joseph D. Patton, Jr., "*Maintainability & Maintenance Management*", Instrument Society of America, 1994.