B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS, CURRICULUM AND SYLLABI

M. Tech.
CONSTRUCTION ENGINEERING & PROJECT MANAGEMENT

JULY 2016

(Updated up to Feb 2019)

VISION AND MISSION

VISION

B.S.Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

VISION & MISSION OF THE DEPARTMENT OF CIVIL ENGINEERING

VISION

To be a leading department for Education, Training and Research in Civil Engineering for a better future and overall socio-economic progress of the country in a sustainable manner.

MISSION

- To offer world class undergraduate, postgraduate and research programs of industrial and societal relevance in civil engineering.
- To nurture ethically strong civil engineers to address global challenges through quality education and application oriented research.
- To educate our students on design, construction, maintenance and advancements in civil engineering for providing solutions to the betterment of the society.
- To prepare competitive and responsible future citizens with good communication, leadership and managerial skills.
- To enrich and enhance the knowledge base for the best practices in various areas of civil & allied engineering through collaborations with Global Institutions of Excellence, Industries and Research organizations.
- To provide a healthy ambience for teaching, research, consultancy and extension activities.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (Construction Engineering & Project Management)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To educate graduates the concepts and practices of management in the construction industry.
- To impart organizational and leadership qualities for effective management of construction projects with ethical responsibility.
- To equip the graduates with knowledge, research and practical skills in modern construction practices and techniques giving importance to sustainable development.
- To provide necessary knowledge and skills in accounting, financing, risk analysis and contracting.
- To train the graduates in the use of relevant software packages for planning, scheduling, executing and controlling of construction projects and inculcate an urge for lifelong learning.
- To function effectively with individual capabilities as well as with a collective strength as a professional team with good communication skills.

PROGRAMME OUTCOMES:

Construction Engineering and Project Management Graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES:

- Identify suitable modern construction materials, techniques, practices and equipments considering effective quality and safety management principles.
- Plan, estimate and schedule construction projects using relevant software's for civil engineering construction
- Implement various contract laws and regulations in the construction industry.

REGULATIONS – 2016
FOR
M. Tech. / MCA / M.Sc. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

i. **"Programme"** means a Post Graduate Degree Programme (M. Tech. / MCA / M.Sc.)

ii. **"Course"** means a theory or practical subject that is normally studied in a semester, like Applied Mathematics, Structural Dynamics, Computer Aided Design, etc.

iii. **"University"** means B.S. Abdur Rahman University, Chennai, 600048.

iv. **"Institution"** unless otherwise specifically mentioned as an autonomous or off campus institution means B.S. Abdur Rahman University.

v. **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this University

vi. **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S. Abdur Rahman University, who administers the academic matters.

vii. **"Dean (P.G. Studies)"** means Dean (P.G. Studies) of B.S. Abdur Rahman University who administers all P.G Programmes of the University in coordination with Dean (Academic Affairs)

viii. **"Dean (Student Affairs)"** means Dean (Student Affairs) of B.S. Abdur Rahman University, who looks after the welfare and discipline of the students.

ix. **"Controller of Examinations"** means the Controller of Examinations of B.S. Abdur Rahman University who is responsible for conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 P.G. Programmes Offered

The various P.G. Programmes and their modes of study are as follows:

Degree	Mode of Study
M. Tech. /M.C.A. / M.Sc.	Full Time & Part Time – Day / Evening / Weekends

2.2 Modes of Study

2.2.1 Full-time

Students admitted under "Full-Time" shall be available in the Institution during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

2.2.2 A full time student, who has completed all non-project courses desiring to do the Project work in part-time mode for valid reasons, shall apply to the Dean (Academic Affairs) through the Head of the Department. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

2.2.3 Part-time

In this mode of study, the students are required to attend classes for the courses in the time slots selected by them, during the daytime (or) evenings (or) weekends.

2.3 Admission Requirements

2.3.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this University as specified in the Table shown for eligible entry qualifications for admission to P.G. programmes or any other degree examination of any University or authority accepted by this University as equivalent thereto.

2.3.2 Eligibility conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by this Institution from time to time.

2.3.3 All part-time students should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by this Institution from time to time.

2.3.4 Student eligible for admission to M.C.A under lateral entry scheme shall be required to have passed three year degree in B.Sc (Computer Science) / B.C.A / B.Sc (Information Technology)

3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

3.1 The minimum and maximum period for completion of the P.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M. Tech. (Full Time)	4	8
M. Tech. (Part Time)	6	12
M.C.A. (Full Time)	6	12
M.C.A. (Part Time)	9	18
M.C.A. (Full Time) – (Lateral Entry)	4	8
M.C.A. (Part Time) – (Lateral Entry)	6	12
M.Sc. (Full Time)	4	8
M. Sc. (Part Time)	6	12

3.2 The PG. programmes consist of the following components as prescribed in the respective curriculum

i. Core courses
ii. General Elective courses
iii. Professional Elective courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Case studies
vii. Seminars
viii. Mini Project
ix. Industrial Internship

3.3 The curriculum and syllabi of all PG. programmes shall be approved by the Academic Council of this University.

3.4 The minimum number of credits to be earned for the successful completion of the programme shall be specified in the curriculum of the respective specialization of the P.G. programme.

3.5 Each academic semester shall normally comprise of 80 working days. Semester-end examinations will follow immediately after the last working day.

ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
01	Civil Engineering	M. Tech. (Structural Engineering)	B.E / B. Tech. (Civil Engineering) / (Structural Engineering)
		M. Tech. (Construction Engineering and Project Management)	
02	Mechanical Engineering	M. Tech. (Manufacturing Engineering)	B.E. / B. Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M. Tech. (CAD/CAM)	
03	Polymer Engineering	M. Tech. (Polymer Technology)	B. E. / B. Tech. Mechanical / Production /Polymer Science or Engg or Tech / Rubber Tech / M.Sc (Polymer Sc./ Chemistry Appl. Chemistry)
04	Electrical and Electronics Engineering	M. Tech. (Power Systems Engg)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
		M. Tech. (Power Electronics & Drives)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
05	Electronics and Communication Engineering	M. Tech. (Communication Systems)	B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation)
		M. Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / Electronics / E&I / I&C / EEE)
06	ECE Department jointly with Physics Dept.	M. Tech. (Optoelectronics and Laser Technology)	B.E. / B. Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc (Physics / Materials Science / Electronics / Photonics)
07	Electronics and Instrumentation Engineering	M. Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE / ICE / Electronics / ECE / EEE)

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
08	Computer Science and Engineering	M. Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
		M. Tech. (Software Engineering)	B.E. / B. Tech. (CSE / IT) MCA
		M. Tech. (Network Security)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
		M. Tech. (Computer Science and Engineering with specialization in Big Data Analytics)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
09	Information Technology	M. Tech. (Information Technology)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
		M. Tech. (Information Security & Digital Forensics)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
10	Computer Applications	M.C.A.	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		M.C.A. – (Lateral Entry)	B.Sc Computer Science / B.Sc Information Technology / B.C.A
		M. Tech. (Systems Engineering and Operations Research)	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
		M. Tech. (Data & Storage Management	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
11	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study.
		M.Sc. Mathematics	B.Sc. (Mathematics)
12	Physics	M.Sc.(Physics)	B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
		M.Sc. (Material Science)	B.Sc.(Physics / Applied Science / Electronics / Electronics

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
			Science / Electronics & Instrumentation)
13	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry / Applied Science)
14	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Genetics	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Sc. Bioscience	B.Sc. in any branch of Life Sciences
		M. Tech. Biotechnology	B. Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

3.6 The curriculum of PG programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Minimum prescribed credits
M. Tech.	73
M.C.A.	120
M.Sc.	72

3.7 Credits will be assigned to the courses for all P.G. programmes as given below:

- One credit for one lecture period per week (or) 15 periods per semester
- One credit for one tutorial period per week
- One credit each for seminar/practical session/project of two or three periods per week
- One credit for two weeks of industrial internship
- One credit for 15 periods of lecture (can even be spread over a short span of time)

3.8 The number of credits registered by a student in non-project semester and project semester should be within the range specified below:

P.G. Programme	Full Time		Part Time	
	Non-project Semester	Project semester	Non-project Semester	Project semester
M. Tech.	9 to 28	12 to 28	6 to 12	12 to 28
M.C.A.	9 to 29	12 to 29	6 to 12	12 to 29
M.Sc.	9 to 25	12 to 20	6 to 12	12 to 20

3.9 The student may choose a course prescribed in the curriculum from any department depending on his / her convenient time slot. All attendance will be maintained course-wise only.

3.10 The electives from the curriculum are to be chosen with the approval of the Head of the Department.

3.11 A student may be permitted by the Head of the Department to choose electives from other PG programmes either within the Department or from other Departments up to a maximum of nine credits during the period of his/her study, with the approval of the Head of the Departments offering such courses.

3.12 To help the students to take up special research areas in their project work and to enable the department to introduce courses in latest/emerging areas in the curriculum, "Special Electives" may be offered. A student may be permitted to register for a "Special Elective" up to a maximum of three credits during the period of his/her study, provided the syllabus of this course is recommended by the Head of the Department and approved by the Chairman, Academic Council before the commencement of the semester, in which the special elective course is offered. Subsequently, such course shall be ratified by the Board of Studies and Academic Council.

3.13 The medium of instruction, examination, seminar and project/thesis/ dissertation reports will be English.

3.14 Industrial internship, if specified in the curriculum shall be of not less than two weeks duration and shall be organized by the Head of the Department.

3.15 Project Work / Thesis / Dissertation

3.15.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a Faculty member in the concerned Department.

3.15.2 A student may however, in certain cases, be permitted to work for the project in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer /

Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review committee meetings for evaluating the progress.

3.15.3 Project work / Thesis / Dissertation (Phase - II in the case of M. Tech.) shall be pursued for a minimum of 16 weeks during the final semester, following the preliminary work carried out in Phase-1 during the previous semester.

3.15.4 The Project Report/Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the concerned department.

3.15.5 The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last working day of the semester in which Project / Thesis / Dissertation is done.

3.15.6 If a student fails to submit the Project Report / Thesis / Dissertation on or before the specified deadline he / she is deemed to have not completed the Project Work / Thesis / dissertation and shall re-register the same in a subsequent semester.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 Class Advisor

A faculty member will be nominated by the HOD as Class Advisor for the whole class.

He / she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 Faculty Advisor

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters and guide the students in taking up courses for registration and enrolment every semester.

5.0 CLASS COMMITTEE

5.1 Every class of the PG Programme will have a Class Committee constituted by the Head of the Department as follows:

i. Teachers of all courses of the programme

ii. One senior faculty preferably not offering courses for the class, as

Chairperson.

iii. Minimum two students of the class, nominated by the Head of the Department.

iv. Class Advisor / Faculty Advisor of the class - Ex-Officio Member

v. Professor in-charge of the PG Programme - Ex-Officio Member.

5.2 The Class Committee shall be constituted by the respective Head of the Department of the students.

5.3 The basic responsibilities of the Class Committee are to review periodically the progress of the classes to discuss problems concerning curriculum and syllabi and the conduct of classes. The type of assessment for the course will be decided by the teacher in consultation with the Class Committee and will be announced to the students at the beginning of the semester. Each Class Committee will communicate its recommendations to the Head of the Department and Dean (Academic Affairs). The class committee, **without the student members,** will also be responsible for finalization of the semester results and award of grades.

5.4 The Class Committee is required to meet at least thrice in a semester, first within a week of the commencement of the semester, second, after the first assessment and the third, after the semester-end examination to finalize the grades.

6.0 COURSE COMMITTEE

Each common theory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers teaching the common course with one of them nominated as Course coordinator. The nomination of the Course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

7.0 REGISTRATION AND ENROLMENT

7.1 For the first semester every student has to register for the courses within one week from the commencement of the semester

7.2 For the subsequent semesters registration for the courses will be done by the student one week before the last working day of the previous

semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should consult his/her Faculty Advisor for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Advisor.

7.3 From the second semester onwards all students shall pay the prescribed fees and enroll on a specified day at the beginning of a semester.

7.4 A student will become eligible for enrolment only if he/she satisfies clause 9 and in addition he/she is not debarred from enrolment by a disciplinary action of the Institution. At the time of enrolment a student can drop a course registered earlier and also substitute it by another course for valid reasons with the consent of the Faculty Advisor. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

7.5 Withdrawal from a course registered is permitted up to one week from the date of the completion of the first assessment test.

7.6 Change of a course within a period of 15 days from the commencement of the course, with the approval of Dean (Academic Affairs), on the recommendation of the HOD, is permitted.

7.7 Courses withdrawn will have to be taken when they are offered next if they belong to the list of core courses.

7.8 A student undergoing a full time PG Programme should have enrolled for all preceding semesters before registering for a particular semester

7.9 A student undergoing the P.G. programme in Part Time mode can choose not to register for any course in a particular semester with written approval from the head of the department. However the total duration for the completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1)

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. Such student has to rejoin only in the same semester from where he left. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

9.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum No. of credits to be earned to enroll for project semester
M. Tech. (Full time / Part time)	18
M.C.A. (Full time / Part time)	45
M.C.A. (Full time / Part time) – (Lateral Entry)	22
M.Sc.(Full time / Part time)	18

9.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0 DISCIPLINE

10.1 Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which will tend to bring down the prestige of the Institution.

10.2 Any act of indiscipline of a student reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

11.0 ATTENDANCE

11.1 Attendance rules for all Full Time Programme and Part time Programmes are given in the following sub-clause.

11.2 Ideally every student is expected to attend all classes and earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% for genuine reasons like on medical grounds, representing the University in approved events etc., to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the student should register for and repeat the course when it is offered next. If the course is an elective, either he/she can register and repeat the same elective or can register for a new elective.

11.3 The students of Full Time mode of study, who have not attended a single hour in all courses in a semester and awarded ‘I’ grade are not permitted

to write the examination and also not permitted move to next higher semester. Such students should repeat all the courses of the semester in the next Academic year.

12.0 SUMMER TERM COURSES

12.1 Summer term courses may be offered by a department on the recommendation of the Departmental Consultative Committee and approved by the Dean (Academic Affairs). No student should register for more than three courses during a summer term.

12.2 Summer term courses will be announced by the Head of the department at the end of the even semester before the commencement of the end semester examinations. A student will have to register within the time stipulated in the announcement. A student has to pay the fees as stipulated in the announcement.

12.3 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters.

Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters, if they wish to improve their continuous assessment marks subject to the approval of the Head of the department.

12.4 Withdrawal from a summer term course is not permitted. No substitute examination will be conducted for the summer term courses.

12.5 The summer term courses are not applicable for the students of Part Time mode.

13.0 ASSESSMENTS AND EXAMINATIONS

13.1 The following rule shall apply to all the PG programmes (M. Tech. / M.C.A. / M.Sc.)

For lecture-based courses, normally a minimum of two assessments will be made during the semester. The assessments may be combination of tests and assignments. The assessment procedure as decided in the Class Committee will be announced to the students right from the beginning of the semester by the course teacher.

13.2 There shall be one examination of three hours duration, at the end of the semester.

13.3 In one (or) two credit courses that are not spread over the entire semester, the evaluation will be conducted at the completion of the course itself. Anyhow approval for the same is to be obtained from the HoD and the

Dean of Academic Affairs.

13.4 The evaluation of the Project work will be based on the project report and a Viva-Voce Examination by a team consisting of the supervisor concerned, an Internal Examiner and External Examiner to be appointed by the Controller of Examinations.

13.5 At the end of industrial internship, the student shall submit a certificate from the organization and also a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a Departmental Committee constituted by the Head of the Department.

14.0 WEIGHTAGES

14.1 The following shall be the weightages for different courses:

i) Lecture based course

Two continuous assessments	50%
Semester-end examination	50%

ii) Laboratory based courses

Laboratory work assessment	75%
Semester-end examination	25%

iii) Project work

Periodic reviews	50%
Evaluation of Project Report by	
External Examiner	20%
Viva-Voce Examination	30%

14.2 Appearing for semester end examination for each course (Theory and Practical) is mandatory and a student should secure a minimum of 40% marks in semester end examination for the successful completion of the course.

14.3 The markings for all tests, tutorial, assignments (if any), laboratory work and examinations will be on absolute basis. The final percentage of marks is calculated in each course as per the weightages given in clause 13.1.

15.0 SUBSTITUTE EXAMINATION

15.1 A student who has missed for genuine reasons any one of the three assessments including semester-end examination of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admissions to a hospital due to illness, etc.

15.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean (Academic Affairs) through the Head of the

department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

16.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

16.1 Based on the semester performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and the corresponding grade points are as follows, but grading has to be relative grading

Letter grade	Grade points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-
I	-
AB	-

- Flexible range grading system will be adopted
- **“W”** denotes withdrawal from the course.
- **"I"** denotes inadequate attendance and hence prevention from semester-end examination
- **"U"** denotes unsuccessful performance in a course.
- **“AB”** denotes absent for the semester end examination

16.2 A student is considered to have completed a course successfully if he / she secure five grade points or higher. A letter grade ‘U’ in any course implies unsuccessful performance in that course.

16.3 A course successfully completed cannot be repeated for any reason.

17.0 AWARD OF LETTER GRADE

17.1 A final meeting of the Class Committee without the student member(s) will be convened within ten days after the last day of the semester end examination. The letter grades to be awarded to the students for different

courses will be finalized at the meeting.

17.2 After finalization of the grades at the class committee meeting the Chairman will forward the results to the Controller of Examinations, with copies to Head of the Department and Dean (Academic Affairs).

18.0 DECLARATION OF RESULTS

18.1 After finalization by the Class Committee as per clause 16.1 the Letter grades awarded to the students in the each course shall be announced on the departmental notice board after duly approved by the Controller of Examinations.

18.2 In case any student feels aggrieved about the results, he/she can apply for revaluation after paying the prescribed fee for the purpose, within one week from the announcement of results.

A committee will be constituted by the concerned Head of the Department comprising of the Chairperson of the concerned Class Committee (Convener), the teacher concerned and a teacher of the department who is knowledgeable in the concerned course. If the Committee finds that the case is genuine, it may jointly revalue the answer script and forward the revised marks to the Controller of Examinations with full justification for the revision, if any.

18.3 The “U” and “AB” grade once awarded stays in the grade sheet of the students and is not deleted when he/she completes the course successfully later. The grade acquired by the student later will be indicated in the grade sheet of the appropriate semester.

19.0 COURSE REPETITION AND ARREARS EXAMINATION

19.1 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

19.2 A student who is awarded “U” or “AB” grade in a course shall write the semester-end examination as arrear examination, at the end of the next semester, along with the regular examinations of next semester courses.

19.3 A student who is awarded “U” or “AB” grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course whenever the course is offered. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the end-semester (re-do) examination.

19.4 If any student obtained "U" or "AB" grade, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

19.5 If a student with "U" or "AB" grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will not be permitted to write the semester end examination and his / her earlier 'U' grade and continuous assessment marks shall continue.

20.0 GRADE SHEET

20.1 The grade sheet issued at the end of the semester to each student will contain the following:

(i) the credits for each course registered for that semester.

(ii) the performance in each course by the letter grade obtained.

(iii) the total credits earned in that semester.

(iv) the Grade Point Average (GPA) of all the courses registered for that semester and the Cumulative Grade Point Average (CGPA) of all the courses taken up to that semester.

20.2 The GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GP_i)}{\sum_{i=1}^{n}(C_i)}$$

where n = number of courses

where C_i is the number of credits assigned for i^{th} course

GP_i - Grade point obtained in the i^{th} course

for the cumulative grade point average (CGPA) a similar formula is used except that the sum is over all the courses taken in all the semesters completed up to the point of time.

'I' and 'W' grades will be excluded for GPA calculations.

'U', 'AB' 'I' and 'W' grades will be excluded for CGPA calculations.

20.3 Classification of the award of degree will be as follows:

20.3.1 For students under full time mode of study

CGPA	Classification
8.50 and above, having completed all courses in first appearance	First class with Distinction
6.50 and above, having completed within a period of 2 semesters beyond the programme period	First Class
All others	Second Class

However, to be eligible for First Class with Distinction, a student should not have obtained U or I grade in any course during his/her study and should have completed the PG Programme within a minimum period covered by the minimum duration (clause 3.1) plus authorized break of study, if any (clause 8). To be eligible for First Class, a student should have passed the examination in all courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

20.3.2 For students under part time mode of study

CGPA	Classification
8.50 and above, having completed all courses in first appearance	First class with Distinction
6.50 and above	First Class
All others	Second Class

For the purpose of classification, the CGPA will be rounded to two decimal places.

21.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

21.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i) successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,

ii) no disciplinary action is pending against him/her.

21.2 The award of the degree must be approved by the University.

22.0 POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

CURRICULUM & SYLLABI FOR M. Tech. (Construction Engineering & Project Management)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6183	Probability and Statistics	**3**	**1**	**0**	**4**
2	CEC6121	Modern Construction Materials and Practices	**3**	**0**	**0**	**3**
3	CEC6122	Construction Equipment Management	**2**	**0**	**0**	**2**
4	CEC6123	Project Management in Construction	**3**	**0**	**0**	**3**
5	CEC6124	Construction Planning, Scheduling and Control	**3**	**0**	**2**	**4**
6	CEC6104	Advanced Concrete Technology	**3**	**0**	**2**	**4**
						20
		SEMESTER II				
1	GEC6201	Research Methodology for Engineers	**4**	**0**	**0**	**4**
2	CEC6231	Construction Economics and Finance	**4**	**0**	**0**	**4**
3	CEC6232	Contract Laws and Regulations	**3**	**0**	**0**	**3**
4		Professional Electives #				**9**
5	CEC6233	Mini Project	**0**	**0**	**2**	**1**
						21
		SEMESTER III				
1		General Elective ###	**3**	**0**	**0**	**3**
2		Professional Electives #				**9**
3	CEC7122	Industrial Internship* / Seminar **	**0**	**0**	**2**	**1**
4	CEC7121	Project Work - Phase I ***	**0**	**0**	**12**	**6**
						13
		SEMESTER IV				
1	CEC7121	Project Phase II	**0**	**0**	**36**	**18**
						6+18=24
		Total				**78**

Student has to take courses for a minimum of 9 credits from list of odd and even semester professional electives.

Student has to take minimum of 3 credits from the list of general electives.

***** 15 days of Industrial training will be undertaken by regular candidates during first year summer vacation and the credit will be awarded in the 3rd semester.

** Seminar will be taken by working Professionals only.

*** Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		LIST OF ODD SEMESTER ELECTIVES				
1	CECY121	Construction Personnel Management	**3**	**0**	**0**	**3**
2	CECY122	Financing and Management of Infrastructure Projects	**3**	**0**	**0**	**3**
3	CECY123	Intelligent Building Management System	**3**	**0**	**0**	**3**
4	CECY124	Management Information System	**3**	**0**	**0**	**3**
5	CECY103	Maintenance and Rehabilitation of Structures	**3**	**0**	**0**	**3**
6	CECY125	Remote Sensing and GIS in Infrastructure Engineering	**3**	**0**	**0**	**3**
7	CECY126	Urban Planning and Design	**3**	**0**	**0**	**3**
8	CECY127	Material Management	**2**	**0**	**0**	**2**
9	CECY128	Construction Safety Management	**2**	**0**	**0**	**2**
10	CECY129	Transportation Planning and Management	**2**	**0**	**0**	**2**
11	CECY130	Lean Construction	**1**	**0**	**0**	**1**
12	CECY131	Site Investigation and Soil Exploration Techniques	**1**	**0**	**0**	**1**
13	CECY132	Air Quality Modeling	**3**	**0**	**0**	**3**
14	CECY133	RS and GIS for Environmental Engineering	**3**	**0**	**0**	**3**
15	CECY134	Transportation modelling and simulation	**3**	**0**	**0**	**3**
16	CECY135	Remote sensing and GIS in transportation development	**3**	**0**	**0**	**3**
		LIST OF EVEN SEMESTER ELECTIVES				
1	CECY221	Construction Quality Management	**3**	**0**	**0**	**3**
2	CECY222	Environmental Impact Assessment of Infrastructure Projects	**3**	**0**	**0**	**3**
3	CECY223	Financial Accounting and Management	**3**	**0**	**0**	**3**
4	CECY224	Green Building and Energy Efficient Structures	**3**	**0**	**0**	**3**
5	CECY225	Green Concepts in Building Environment	**3**	**0**	**0**	**3**
6	CECY226	Infrastructure Planning and Management	**3**	**0**	**0**	**3**
7	CECY227	Shoring, Scaffolding and Formwork	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
8	CECY228	Affordable Housing	**2**	**0**	**0**	**2**
9	CECY229	Application of Information Technology in Infrastructure Management	**1**	**0**	**2**	**2**
10	CECY230	Cost Estimation and Control	**2**	**0**	**0**	**2**
11	CECY231	Construction Risk Management	**1**	**0**	**0**	**1**
12	CECY232	Project Management for Smart Cities	**3**	**0**	**0**	**3**
13	CECY234	Adsorption And Kinetics	**3**	**0**	**0**	**3**
14	CECY235	Environmental Nanotechnology	**3**	**0**	**0**	**3**
15	CECY236	Architecture Pedagogy	**3**	**0**	**0**	**3**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**1**	**0**	**2**	**2**
13	GECY113	PYTHON Programming	**1**	**0**	**2**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC6183 PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

OBJECTIVE:

This course intends to provide

- a comprehensive introduction to the probability distributions,
- familiarize with testing of hypothesis and estimation theory.
- basic knowledge in simulations used in engineering.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total Probability – random variables- moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 09+03

Joint distributions - Marginal and conditional distributions – functions of random variables - Covariance - Correlation and regression - Central limit theorem.

MODULE III ESTIMATION THEORY 09+03

Partial, Multiple correlations and regressions – Estimation of parameters using maximum likelihood estimator and method of moments.

MODULE IV TESTING OF HYPOTHESIS 08+03

Hypothesis, test statistic, decisions and errors - classical testing, significance and p-values – Student's t- test , Fisher's test and Chi-square tests.

MODULE V SIMULATION **09+03**

Simulation - definition - Monte Carlo simulation - random number generation, simulation model building - validation - run size determination - simulation applications - inventory control - facilities creation, simulation software.

L – 45; T – 15; Total : 60

TEXT BOOKS:

1. Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 4th Edition, Wiley publication, 2006.
2. Richard A. Johnson, “Probability and Statistics for Engineers”, 6th Edition, Pearson Education, Indian Reprint, 2002.
3. Sheldon M. Ross, “Introduction to probability models”, 10th edition, Academic Press, 2009.

REFERENCES:

1. Jerry Banks, John S. Carson, Barry L. Nelson, “Discrete – Event systems Simulation”, Prentice Hall India, New Delhi, 1999.
2. Jay L. Devore, “Probability and Statistics for Engineering and the Sciences”, Duxbury publication, 2007.
3. R. Lyman Ott, Michael Longnecker, “An Introduction to Statistical Methods and Data Analysis”, 6th edition, Brooks/Cole Cengage Learning, USA, 2010.

OUTCOME:

At the end of the course students will be able to

- identify and fit probability distribution for a given data.
- solve problems in modeling using simulation techniques.

CEC 6121	MODERN CONSTRUCTION MATERIALS AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge regarding the properties of modern construction materials used in construction and their suitability of applications in construction industry.
- To impart students the knowledge on modern construction practices related to sub structure, super structure and prefabricated construction.

MODULE I METALS AND NON STRUCTURAL MATERIALS 09

Metals

Different types of steel, aluminium and their products - other alloys - applications in civil engineering – Non structural materials - water proofing compounds-types - non weathering materials - flooring - types - materials used for flooring - properties - facade materials - types - properties - selection - insulation materials - coatings - eco friendly materials - polymers.

MODULE II SMART AND INTELLIGENT MATERIALS 09

Smart materials – shape memory alloys - application in construction - smart windows -types - intelligent materials - nano materials - coatings & paints - nano sensors- aerogels - phase changing materials - translucent concrete – sensiTile - electrified wood – flexicomb - self-repairing cement/concrete - liquid granite - bendable concrete

MODULE III SUBSTRUCTURE CONSTRUCTION 09

Box jacking - pipe jacking - under water construction of diaphragm walls and basement - methods - stand by plant equipment for underground open excavation. underwater construction – problems, encountered. underwater concreting – Sequence of construction activities for tunnels

MODULE IV SUPER STRUCTURE CONSTRUCTION 09

Formwork& scaffolding – lift slab construction - drop slab construction - ready mix concrete - modes of transporting & continuous concrete placing in tall structure - erection techniques for tall structures, large span structures – launching techniques for heavy decks - Sequence of construction activities for bridges, tall Structures and dams

MODULE V PREFABRICATED STRUCTURES 09

Prefabricated structures - methods, techniques used – advantages - precautions, and pre engineered structures – practices and techniques, fast track construction – modern practices, materials and techniques used- interlocking panels – FRP Panels

Total Hours: 45

REFERENCES:

1. Mamlouk, M.S. and Zaniewski J.P, Materials for Civil and Construction Engineers, Prentice Hall Inc., 2011.
2. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, 8th Edition, McGraw Hill, Singapore, 2010.
3. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008
4. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 1997.

OUTCOME:

At the end of the course, the student will be able to

- select the materials such as metal and non structural materials for various applications in construction.
- explain the advantages of using smart material in construction.
- choose the suitable technique to be adopted in sub structure construction.
- identify the appropriate technique to be used in super structure construction.
- defend the usage of pre fabricated structures in modern construction.

CEC6122 CONSTRUCTION EQUIPMENT MANAGEMENT

L	T	P	C
2	0	0	2

OBJECTIVE

- To impart knowledge about various equipments and methods used in construction Industry

MODULE I EARTH WORK EQUIPMENTS AND MATERIAL HANDLING EQUIPMENT 10

Fundamentals of earthwork operations-earth moving operations-types of earthwork equipment – tractors, motor graders, scrapers, front end waders, earth movers.- forklifts and related equipment- -cranes - hauling equipments and methods.

MODULE II OTHER CONSTRUCTION EQUIPMENTS 06

Equipments and methods for dredging, trenching, tunneling, drilling, blasting - equipment for compaction - erection methods and equipments-types of pumps used in construction - equipment and methods for dewatering and grouting - foundation and pile driving equipment.

MODULE III AGGREGATE AND CONCRETING EQUIPMENT 06

Crushers- feeders - screening equipment - handling equipment – batching and mixing equipment - pouring and pumping equipment - transporters and related methods- portable material bins - conveyors.

MODULE IV COMPACTION AND STABILIZATION OF EARTH MATERIALS 08

Compaction and stabilization of geotechnical materials-Selection of equipments – machine power- planning of construction plant and equipment with emphasis on site application - site layout – safety in handling equipments.

Total Hours: 30

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., Construction Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore, 2010.
2. Sharma S.C., Construction Equipment and its Management, Khanna Publishers New Delhi, 2002.

3. Deodhar, S.V., Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001.
4. Saxena SC, Construction Equipment and Planning, Standard Publishes-Distributors-Delhi, 2009.

OUTCOME:

At the end of the course, students will be able to

- calculate the earthwork volume for cutting and filling
- interpret mass haul diagram for construction activities
- describe the features of construction equipments
- explain the methods for stabilization of soil
- identify suitable equipments according to the construction work
- describe the construction equipment safety measures

CEC6123 PROJECT MANAGEMENT IN CONSTRUCTION

L	T	P	C
3	0	0	3

OBJECTIVE:

To impart knowledge on

- project life cycle of construction projects
- organization for project management
- utilization of labour, material and equipment
- International construction risks

MODULE I PROJECT MANAGEMENT 09

Introduction - project life cycle - major types of construction - construction project participants - project procurement – appointment of parties to the contract - construction contracts – project managers – project management functions – financing alternatives – legal and regulatory requirements.

MODULE II CONSTRUCTION COMPANY ORGANIZATION 09

Trends in modern management - company objectives – company policies & Strategy – company organizational structures - effects of project risks on organization – project delivery systems - management attitude -perceptions of owners and contractors

MODULE III THE DESIGN AND CONSTRUCTION PROCESS 09

Design and construction as an integrated system-Innovation and technological Feasibility-Innovation and technological feasibility-Design Methodology-Functional Design-Physical Structures-Geo-Technical Engineering Investigation-Construction Site Environment-Value engineering-Construction Planning-Industrialized Construction and Prefabrication-Computer -Aided Engineering.

MODULE IV LABOUR,MATERIAL AND EQUIPMENT UTILIZATION 09

Historical perspective - labour productivity - factors affecting job - site productivity - labor relations in construction - problems in collective bargaining - materials management - materials procurement and delivery- inventory control -tradeoffs of cost in material management - construction equipment - choice of equipment and standard production rates-construction processes queues and resource bottlenecks.

MODULE V INTERNATIONAL CONSTRUCTION LOGISTICS AND RISKS 09

The international environment – seeking international work –project funding – finance and payment – conditions of contract – documentation and bureaucracy – construction labor – equipment – materials and equipment support items - supply and delivery – forming partnerships

Total Hours : 45

REFERENCES:

1. Frank Harris & Ronald McCaffer with Francis Edum – Fotwe, Modern Construction Management, Sixth Edition, Blackwell Publishing, 2006.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 201.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
5. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
6. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

OUTCOME:

Upon completion of the course, students will be able to

- define project life cycle and project management functions
- outline the company's attitudes and activities, easing the transition from site to general management
- demonstrate and explain the various design and construction process
- interpret and apply various resource productivity for effective utilization
- summarize the problems in raising finance and dealing with unfamiliar conditions in international scenario.

CEC6124	CONSTRUCTION PLANNING SCHEDULING AND CONTROL	L	T	P	C
		3	0	2	4

OBJECTIVE:

To impart knowledge about

- planning construction projects
- scheduling the activities using network diagrams
- determining the cost of the project
- controlling the productivity of the project
- using the project information as an information and decision making tool
- process of planning and Scheduling of various construction projects using softwares

MODULE I CONSTRUCTION PLANNING 08

Basic concepts in the development of construction plans - choice of technology and construction method – project planning – functions of planning– objectives and policies- types and stages of planning- defining work tasks- work break down structure – bill of quantity (boq) - hierarchy of plan - coding systems – human aspects of project management- project definition rating index (PDRI).

MODULE II SCHEDULING TECHNIQUES 10

Development of project network - AOA and AON diagrams - defining precedence relationships among activities - estimating activity durations - estimating resource requirements for work activities - critical path method – PERT- construction schedules – scheduling calculations - float - presenting project schedules - scheduling for activity-on-node and with leads, lags, and windows.

MODULE III SCHEDULING WITH UNCERTAIN DURATION 09

Use of advanced scheduling techniques - scheduling with uncertain durations - calculations for monte carlo schedule simulation - crashing and time/cost tradeoffs - improving the scheduling process.- resources, leveling resources, resource leveling strategies- scheduling with resource constraints.

MODULE IV CONSTRUCTION CONTROL 09

Project integrated control system frame work- work scope control- product quality control- labour productivity control- equipment productivity control- material productivity control- ‘What-if’ analysis- time progress monitoring methodology- critical chain project management (CCPM).

MODULE V ORGANIZATION AND USE OF PROJECT INFORMATION 09

Types of project information - accuracy and use of information - computerized organization and use of information - organizing information in databases - relational model of databases - other conceptual models of databases - centralized database management systems - databases and applications programs - information transfer and flow- Product Data Management (PDM)- Line Of Business (LOB).

MODULE VI PLANNING AND SCHEDULING USING MS PROJECT 15

Planning and scheduling of a multi storey building - assigning activities in sequence – assigning duration for activities – preparation of Gantt chart – planning and scheduling of a road construction project

Preparation of resource sheet – assigning and leveling of resources – report preparation – variance graphs.

L : 45; P : 15; Total Hours: 60

REFERENCES:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
3. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
4. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
5. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

OUTCOME:

Upon the completion of the course students will be able to

- plan the construction projects with coding and work breakdown structure.
- create a schedule for project using network diagrams.
- resolve scheduling constrains using advanced techniques.
- control the productivity of a construction projects.
- identify the project information as an information and decision making tool.
- create a plan and schedule of various construction projects using various software’s.

CEC 6104 ADVANCED CONCRETE TECHNOLOGY

L	T	P	C
3	0	2	4

OBJECTIVE:

- To impart sufficient knowledge to students about properties of various concrete constituent materials, mix design for different types of concrete, fresh and hardened properties of concrete.
- To provide students knowledge on durability properties of concrete and different types of special concretes.

MODULE I CONCRETE CONSTITUENT MATERIALS 09+06

Cement - Grades and types - properties and testing as per Indian standards. Fine aggregate - coarse aggregate - classification - properties - testing as per Indian standards. Water - quality, properties and requirements. Mineral admixtures - fly ash, silica fume, metakaoline, ground granulated blast furnace slag, rice husk ash, titanium dioxide. Chemical admixtures - Super plasticizers, water reducers, set accelerators, set retarders, air entraining agents, viscosity modifying agents, corrosion inhibiting admixtures - working mechanism and application areas.

MODULE II CONCRETE MIX DESIGN 09+06

Principles of concrete mix design. Mix design for different types of concrete - control concrete, self compacting concrete, high performance concrete and ready mix concrete - Indian standards - ACI method - relevant standards. Design concrete mix for a desired application and subsequent validation.

MODULE III PROPERTIES OF FRESH AND HARDENED CONCRETE 09+06

Fresh concrete properties of control concrete, self compacting concrete and high performance concrete – workability related tests - slump, compaction factor, vee bee consistometer, flow test, L-box test, U-box test, V-funnel test, J-ring test. Hardened concrete properties – strength – modulus of elasticity – creep – shrinkage - bond strength.

MODULE IV DURABILITY PROPERTIES OF CONCRETE 09+06

Deteriorating mechanism: sulphate attack, alkali aggregate reaction, corrosion of steel rebar - mechanism, causes and consequences. Tests related to durability properties - water absorption, permeability, sorptivity, resistance to chemical attack, freeze and thaw resistance, accelerated corrosion test, RCPT test, half-cell potential test and macrocell corrosion test.

MODULE V SPECIAL CONCRETE 09+06

High performance concrete – fibre reinforced concrete – self compacting concrete - polymer concrete composites - light weight concrete – pervious concrete – ferrocement – shotcrete – coloured concrete – heavy density concrete.

Total Hours : 75

REFERENCES:

1. N.V. Nayak and A.K. Jain, “Handbook on Advanced Concrete Technology”, Narosa Publishing House Pvt. Ltd., New Delhi, 2012.
2. Neville, A.M., “Properties of Concrete”, Fourth Edition, John Wiley & Sons, London, 1996.
3. M.S. Shetty, “Concrete Technology”, S. Chand and Company Ltd., New Delhi, 2003.
4. A.R. Santhakumar, “Concrete Technology”, Oxford University Press, New Delhi, 2007
5. N. Krishnaraju, “Design of Concrete Mixes”, CBS Publishers, New Delhi, 2007.
6. Mehta P.K., and Paulo J.M. Monteiro, “Concrete: Microstructure, Properties, and Materials”, McGraw-Hill Professional, USA, 2005.
7. Yoshihiko Ohama, “Hand Book of Polymer-modified Concrete and Mortars – Properties and Process Technology”, Noyes Publications, 1995.
8. BIS 10262 – 1999, “Recommended Guidelines for Concrete Mix Design”, Bureau of Indian Standards, New Delhi.
9. ACI Committee 211.1 – 1991, “ Standard Practice for Selecting Proportions for Normal, Heavy weight, and Mass concrete (Part – I)”, ACI Manual of Concrete Practice, 1994.
10. ACI Committee 549.1R – 2009, “Guide for the Design, Construction and Repair of Ferro Cement”, American Concrete Institute, USA.
11. BIS 383 – 1970, “Specification for Coarse and Fine Aggregates from Natural Sources for Concrete”, Bureau of Indian Standards, New Delhi.
12. BIS 516 – 1968, “Methods of Tests for Strength of Concrete”, Bureau of Indian Standards, New Delhi.
13. BIS 1199 – 1959, “Methods of Sampling and Analysis of Concrete”, Bureau of Indian Standards, New Delhi.
14. BIS 2386 (Part I & 3) - 1963, “Methods of Test for Aggregates for Concrete”, Bureau of Indian Standards, New Delhi.
15. BIS 4031 (Part 1-6) : 1996, “Method of Physical Tests for Hydraulic

Cement", Bureau of Indian Standards, New Delhi.
16. BIS 5816-1999, Splitting Tensile Strength of Concrete - Method of Test, Bureau of Indian Standards.
17. BIS 13311 - 1992, Non destructive testing of concrete - Method of test, Part -2: Rebound Hammer, Bureau of Indian Standards.

OUTCOME:

On completion of these modules, students will be able to

- conduct tests assess the properties of concrete constituent materials and its validation for the desired application.
- perform mix design for normal concrete, self compacting concrete and high performance concrete as per specified standards.
- conduct tests as per codal provisions to assess the fresh concrete and hardened concrete properties.
- carryout durability studies on different types of concrete.
- suggest type of concrete based on application and durability requirements.

GEC6201 RESEARCH METHODOLOGY FOR ENGINEERS

L	T	P	C
4	0	0	4

OBJECTIVE:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, experimental design – principle – important experimental designs, Design of experimental setup, mathematical modeling, simulation – validation and experimentation, dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –hypothesis testing- sample design- design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - use of optimization techniques – traditional methods – evolutionary optimization techniques –transportation model

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts-Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, thesis writing – organization of contents – style of writing – graphs and charts – referencing, oral presentation and defence, ethics in research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOME:

Students who complete this course will be able to

- identify the research problem.
- analyze the data using mathematical techniques.
- apply the statistical concepts in research.
- demonstrate the different research methods applicable to a specific problem.

CEC6231 CONSTRUCTION ECONOMICS AND FINANCE

L	T	P	C
3	1	0	4

OBJECTIVE:

To impart knowledge about

- economic studies considering the time value of money
- the demonstration of different methods for the comparison of alternatives
- different methods of depreciation, taxes, and cost analysis of construction equipments
- cost estimating
- financial management

MODULE I ENGINEERING ECONOMICS 15

Introduction – Time value of money - quantifying alternatives for decision making - Cash flow diagrams - Equivalence- Single payment in the future (P/F, F/P) - Present payment compared to uniform series payments (P/A, A/P) - Future payment compared to uniform series payments (F/A, A/F) - Arithmetic gradient - Geometric gradient – Tutorial Problems

MODULE II COMPARISON OF ALTERNATIVES 12

Present, future and annual worth method of comparing alternatives - rate of return - incremental rate of return - break-even comparisons - capitalized cost analysis - benefit-cost analysis – tutorial problems

MODULE III EQUIPMENT ECONOMICS 12

Depreciation – inflation – taxes - equipment costs - ownership and operating costs - buy/rent/lease options – replacement analysis – tutorial problems

MODULE IV COST ESTIMATING 09

Types of estimates - approximate estimates – unit estimate - factor estimate - cost indexes - parametric estimate - life cycle cost – case study – tutorial problems

MODULE V FINANCIAL MANAGEMENT 12

Construction accounting - chart of accounts - financial statements – profit and loss - balance sheets - financial ratios - working capital management – case study – tutorial problems

Total Hours: 60

REFERENCES:

1. Blank, L. T. and Tarquin, A. J., “Engineering Economy”, Fourth Edition, WCB/McGraw-Hill, 1998.
2. Bose, D. C., “Fundamentals of Financial management”, 2nd ed., PHI, New Delhi, 2010.
3. Gould, F. E., “Managing the Construction Process”, 2nd ed., Prentice Hall, Upper Saddle River, New Jersey, 2002.
4. Gransberg, D. G., Popescu, C. M. and Ryan, R. C., “Construction Equipment Management for Engineers, Estimators, and Owners, CRC/Taylor & Francis, Boca Raton, 2006.
5. Harris, F. , McCaffer, R. and Edum-Fotwe, F., “Modern Construction Management”, 6th ed., Blackwell Publishing, 2006.
6. Peterson, S. J., “Construction Accounting and Financial Management”, Pearson Education, Upper Saddle River, New Jersey, 2005
7. Sullivan, W. G., Bontadelli, J. A. and Wicks, E. M., “Engineering Economy”, 11th ed., Prentice Hall, Upper Saddle River, New Jersey, 2001.

OUTCOME:

Upon completion of the course, students will be able to

- understand construction economics relating to time value of money
- analyze the various methods of alternatives based on present future and annual worth
- demonstrate and explain the choices of equipment selection with respect to buying, renting or leasing options.
- interpret and apply various cost estimating methods to calculate life cycle cost of a project.
- provide an overview of the financial management including construction accounting

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CEC6232 CONTRACT LAWS AND REGULATIONS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To improve the knowledge of the students in various elements of contract, tendering procedures, arbitration, labor regulations and other laws related to it.

MODULE I CONSTRUCTION CONTRACTS 09

Indian contracts act – elements of contracts – types of contracts – public private partnership in contract - design of contract documents – international contract document - FIDIC– standard contract document – law of torts – fatigue contract.

MODULE II TENDERS 09

Prequalification – bidding – accepting – evaluation of tender from technical, contractual and commercial points of view – contract formation and interpretation – potential contractual problems – world bank procedures and guidelines – tamilnadu transparency in tenders act.

MODULE III ARBITRATION 09

Arbitration agreement- condition for arbitration- composition of arbitral tribunal-number of arbitrators, appointment of arbitrators, power and duties of arbitrator, ground for challenges, termination of mandate, substitution of arbitrator-jurisdiction of arbitral tribunals- conduct of arbitral proceedings- rules of evidence-default of a party- arbitral awards- termination of award- recourse against arbitral award- finality and enforcement of arbitral award- appeal against arbitral award-Newyork convention award- Geneva convention award- Foreign arbitral award.

MODULE IV LEGAL REQUIREMENTS 09

Insurance and bonding – laws governing sale, purchase and use of urban and rural land – land revenue codes – tax laws – income tax, sales tax, excise and custom duties and their influence on construction costs – legal requirements for planning – property law – agency law – benefits in public private partnership - local government laws for approval – statutory regulations.

MODULE V LABOUR REGULATIONS 09

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 Labour Act - Other Labour Laws

Total Hours: 45

REFERENCES:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 2000.
2. Jimmie Hinze,Construction Contracts, McGraw Hill, 2001.
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
4. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press Private Limited, India, 2006.
5. The Indian Contracts Act, 1872,
6. Arbitration and Conciliation Act, 1996.
7. The Tamilnadu Transparency in Tenders act, 1998.

OUTCOME:

At the end of the course the students will be able to

- define the various elements, types and laws related to contract.
- list the various processes involved in tendering.
- elaborate the process involved in construction arbitration.
- describe the various legal requirements related to construction activities.
- list the available labor regulations and its benefits to the labour.

CEC6233	MINI PROJECT	L	T	P	C
		0	0	3	1

GENERAL GUIDELINES:

- The project aims to impart knowledge in construction planning and scheduling and to complement the practical work abilities of the students.
- The project allows students to generalize, apply and synthesize the concepts learned over the duration of the course.
- This approach encourages students to work as a team and “learn by doing”, thereby develop the problem-solving skills which is fundamental to industry practice in the field of construction management.
- Students, working in groups of two or individually, must identify a construction project, Prepare a feasibility report for the project and list the activities, establish an activity logic sequence table, estimate the duration, prepare a network diagram, track, update and crash the project.
- The students are expected to implement the same plan using Project Management softwares.
- The faculty act as facilitator in helping students to acquire the technical knowledge and basic proficiency needed to perform the master plan.

ODD SEMESTER PROFESSIONAL ELECTIVES

CECY121 CONSTRUCTION PERSONNEL MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on man power planning, organization, people management and their welfare measures.

MODULE I MANPOWER PLANNING 09

Manpower planning, organizing, staffing, directing, and controlling – personnel principles – case studies.

MODULE II ORGANISATION 09

Organization – span of control – organization charts – staffing plan - development and operation of human resources - managerial staffing – recruitment – selection - placement, training and development

MODULE III HUMAN BEHAVIOUR 10

Introduction to the field of people management - basic individual psychology; motivation - job design and performance management - managing groups at work - self-managing work teams - intergroup behavior and conflict in organizations – leadership - behavioral aspects of decision-making; and communication for people management

MODULE IV WELFARE MEASURES 07

Compensation – Safety and health – GPF – EPF – group insurance – housing - pension – laws related to welfare measures.

MODULE V MANAGEMENT AND DEVELOPMENT METHODS 10

Compensation - wages and salary, employee benefits, employee appraisal and assessment - employee services - safety and health – discipline and discharge - special human resource problems, performance appraisal - employee hand book and personnel manual - job descriptions and organization structure and human relations – productivity of human resources.

Total Hours: 45

REFERENCES:

1. Carleton Counter II, Jill Justice Coutler, The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989.
2. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.
3. Josy.J. Familaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1985.
4. Dwivedi R.S, Human Relations and Organizational Behavior, Macmillan India Ltd., 2005.

OUTCOME:

At the end of the course, students will be able to

- classify and explain various man power resources required in construction industry
- outline the organizational structure and demonstrate staffing plans for a construction company.
- apply interpersonal human behavior principals to improve the morale and behavioral aspects of human resources.
- demonstrate various welfare measures available to human resources.
- analyze the various development benefits and principles to effectively manage the resources and increase in productivity

CECY122	FINANCING AND MANAGEMENT OF INFRASTRUCTURE PROJECTS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To provide an understanding and appreciation of financing technique widely used to finance infrastructure projects
- To provide an exposure to various innovative financing methods and its applicability in infrastructure projects.
- To provide an understanding about public private parternership and risks associated with it.

MODULE I INFRASTRUCTURE DEVELOPMENT – INTRODUCTION 09

Infrastructure development - Multiplier effects of infrastructure development on economic development of the nation - Sources of financing infrastructure projects; Traditional and private investments; various financial instruments; Limitations of traditional procurement system of infrastructure; Legal frameworks and Incentives for private sector participation in infrastructure development.

MODULE II PUBLIC PRIVATE PARTNERSHIPS – PROCUREMENT PROCESS 09

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 concessionaire; government's role in successful PPP projects; appraisal of projects; VFM evaluation; PPP procurement process; lifecycle of PPP projects; contractual package of PPP project; bankable concession agreement - case study

MODULE III CONCESSION – DESIGN AND AWARD 09

Introduction to concession design and award; concession design: price setting; price adjustment; specific performance targets; penalties and bonuses; public parties' security rights; duration, termination, and compensation; force majeure and other unforeseen changes; dispute settlement; concession award: competitive bidding; direct negotiations and unsolicited proposals; competitive negotiations; prequalification and unsolicited proposals; competitive negotiations; prequalification and short listing; bid structure and evaluation; bidding rules and procedures; case study

MODULE IV RISK MANAGEMENT OF INFRASTRUCTURE PROJECTS 09

Risks associated with various infrastructure projects; Introduction to risk

management concept; risk analysis techniques; risk mitigation strategies; risk allocation frameworks of major infrastructure projects procured through various ppp modes - environmental concerns and its impact on infrastructure development.

MODULE V PROJECT FINANCE 09

Introduction to project financing concept; analysis of project viability; designing security arrangements; preparing the project financing plan; introduction to credit rating of infrastructure projects and role of credit ratings in financing infrastructure projects; rating frameworks of various national and international credit rating agencies for infrastructure projects in various sectors. financing through international capital markets; urban infrastructure financing.

Total Hours: 45

REFERENCES:

1. Akintoye. A., Beck, M., & Hardcastle, C., Public-Private Partnerships - Managing risks and opportunities, Oxford: Blackwell Science Limited, 2003.
2. Finnerty, J. D. Project financing - Asset-based financial engineering, NewYork: John Wiley & Sons, Inc, 2013.
3. Merna, T., & Njiru, C. Financing infrastructure projects (First ed.), Thomas Telford, London, 2002.
4. Raghuram, G., Jain, R., Sinha, S., Pangotra, P., & Morris, S., Infrastructure Development and Financing: Towards a Public-Private Partnership, MacMillan, 2000.
5. Weber, B., & Alfen, H.W. Infrastructure as an asset class - Investment strategies, project finance and PPP, West Sussex: John Wiley & Sons, 2010.

OUTCOME:

Upon Completion of this course the learner will be able to

- demonstrate the need for Infrastructure development for the growth of a country and explain the various means of financing an Infrastructure project
- summarize the types, benefits and limitations of PPP.
- develop the methods of procurement of infrastructure projects
- deal with risk associated with Infrastructure Projects

- appraise and access the various financial options to fund an Infrastructure project.

CECY123	INTELLIGENT BUILDING MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVE:

To provide knowledge on

- concepts of intelligent buildings
- working principles of building automation systems
- office automation systems and communication systems

MODULE I INTRODUCTION 09

Introduction to intelligent buildings - high performance buildings - basic concepts of intelligent buildings - intelligent building automation - building automation system- cost analysis of intelligent buildings – introduction to smart materials and embedded sensor technology – BMS and energy savings – BMS benefits

MODULE II INTELLIGENT COMFORT SYSTEMS 09

Introduction - Basic HVAC system - human comfort - artificial intelligent systems – occupancy sensors – temperature sensors; energy efficient HVAC systems – thermal energy storage – under floor air distribution – chilled beams – Other emerging HVAC technologies for high performance buildings - automated car parking management

MODULE III INTELLIGENT SAFETY SYSTEMS 09

Life safety factors – designing a security system- intrusion sensors and space sensors -closed circuit television & surveillance systems; access control & management system - portrait id system, swipe card access control system, biometric access control system; fire protection systems - smoke detection- automatic fire alarm detection – sprinklers -hose reels hydrants-foam systems - microprocessor based alarm. emergency control of elevator, doors, hvac systems; security & alarm system

MODULE IV BUILDING ELECTRONICS 09

Introduction - microprocessor based control - programmable logic controller – Communication principles - telephone systems - communal aerial broadcasting - satellite communication - fibre optic system

MODULE V PERFORMANCE BUILDINGS 09

High performance buildings - control theory - market trends - energy efficiency - environmental & green house gas emission reduction - CDM - practical benefits;

case studies & examples-smart home - smart office.

Total Hours: 45

REFERENCES:

1. Shengwei Wang, Intelligent Buildings and Building Automation, Spon Press, London, 2009.
2. Derek Clements Croome, Intelligernt Building Design, Management and Operations, 2nd edition, ICEP Publishers, London, 2012.
3. Ehrlich, C., Intelligent Building Dictionary: Terminology for Smart, Integrated Green Building Design, Construction, and Management San Francisco, Handson-Guide, 2007.

OUTCOME:

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

- illustrate the concept of Intelligent Buildings and compare the costs, energy savings applied to Building Management Systems.
- demonstrate and explain the various Intelligent Comfort Systems
- demonstrate and explain the various Intelligent Safety Systems
- construct a simple electronic system
- analyze high performance buildings based on energy efficiency

CECY124	MANAGEMENT INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVE:

To lay emphasis on

- the various information systems
- their framework
- their methods of implementation, control and audit

MODULE I INTRODUCTION 09

Information systems - establishing the framework - business models - information system architecture - evolution of information systems.

MODULE II SYSTEM DEVELOPMENT 09

Modern information system - system development life cycle – structured methodologies - designing computer based methods, procedures, control - designing structured programs.

MODULE III INFORMATION SYSTEMS 09

Integrated construction management information system - project management information system - functional areas, finance, marketing, production, personnel - levels, dss, eis, and es - comparison, concepts and knowledge representation - managing international information system.

MODULE IV IMPLEMENTATION AND CONTROL 09

Control - testing security - coding techniques - defection of error - validating - cost benefit analysis - assessing the value and risk of information system.

MODULE V SYSTEM AUDIT 09

Software engineering qualities - design, production, service, software specification, software metrics, software quality assurance - systems methodology - objectives - time and logic, knowledge and human dimension - software life cycle models - verification and validation.

Total Hours: 45

REFERENCES:

1. Kenneth C Laudon and Jane Price Laudon, Management Information Systems Organisation and Technology, Prentice Hall, 1996.

2. Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.
3. Joyce J Elam, Case series for Management Information Systems, Simon and Schuster, Custom Publishing, 1996.
4. Ralph H Sprague and Huge J Watson, Decision Support for Managers, Prentice Hall, 1996.
5. Michael W. Evans and John J Marciniah, Software Quality assurance and Management, John Wiley and Sons, 1987.
6. Card and Glass, Measuring Software Design quality, Prentice Hall, 1990.

OUTCOME:

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

- explain the procedures for successfully managing information systems in projects.
- identify the system development for designing structured problems.
- identify the international information system.
- analyse the coding techniques.
- design the verification and validation for system audit.

CECY103	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart students sound knowledge on various causes of failures, detailed assessment procedure for evaluating a distressed structure, materials available for effecting repair and techniques for effective rehabilitation.
- To offer knowledge to students on rehabilitation of real time distressed structures through case studies.

MODULE I CAUSES FOR FAILURES 09

Effects due to climate, temperature, chemicals, wear and erosion - design and construction errors. Corrosion – Mechanism, causes, consequences and remedial measures - effect of cover thickness and cracking on durability of concrete.

MODULE II MAINTENANCE AND ASSESSMENT PROCEDURE 09

Definition: Maintenance, repair and rehabilitation - facets of maintenance - importance of maintenance. Assessment procedure for evaluating a damaged structure - various aspects of inspection - destructive and non–destructive testing techniques.

MODULE III MATERIALS FOR REPAIR 09

Special concretes and mortar - concrete chemicals - elements for accelerated strength gain - expansive cement - polymer concrete composites - ferro cement - fibre reinforced concrete- fibre reinforced polymer composites - micro concrete. Methods of corrosion protection - corrosion inhibitors - protective coating materials for rebar and concrete - corrosion resistant steel - cathodic protection.

MODULE IV TECHNIQUES FOR REPAIR 09

Rust converters and polymer coating for rebars during repair - repair mortar for cracks - bonding agents - epoxy injection - guniting and shotcrete - FRP and ferro cement jacketing - vacuum concreting - bonding plates - overlays - protective coatings - shoring and underpinning technique.

MODULE V REHABILITATION OF STRUCTURES - CASE STUDIES 09

Case studies on repairs to overcome low member strength - deflection - cracking - chemical attack - damage due to wear - leakage - fire - marine exposure and corrosion. Engineered demolition techniques for dilapidated structures - case study.

Total Hours : 45

REFERENCES:

1. Santha Kumar A.R., “Concrete Technology”, Oxford University Press, (2007).
2. Shetty M.S., “Concrete Technology – Theory and Practice”, S. Chand & Company Limited (2008).
3. Orchard D.F., "Concrete Technology -Vol. I - Properties of Materials, Wiley Publishers, 2010.
4. Yoshihiko Ohama, “Hand Book of Polymer – Modified Concrete and Mortars”, Noyes Publications, 1995.
5. Philip H. Perkins, "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 1986.
6. W.H. Ransom, "Building Failures - Diagnosis and Avoidnce", E.& F.N. Spon Publishers, 1987.
7. Michael T. Kubal, "Waterproofing the Building Envelope", Mc-Graw Hill Inc., 1993.

OUTCOME:

At the end of course work students will be able to

- specify the various causes for distress in reinforced concrete structures.
- conduct systematic condition assessment of damaged structures using conventional and non-destructive testing methods.
- suggest suitable materials for repair based on damage level, deterioration mechanism and durability requirements of the distressed structures.
- recommend repair techniques for rehabilitation of damaged structural elements based on deterioration level, serviceability and durability requirements.
- specify rehabilitation procedure for fire affected, corrosion affected and other structurally distressed members and engineered demolition techniques.

CECY125	REMOTE SENSING AND GIS IN INFRASTRUCTURE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To make the student acquainted regarding the principles of remote sensing and the data acquisition and analysis of satellite data.
- To provide exposure to data models and data structure used in GIS.
- To introduce various raster and vector analysis capabilities of GIS for civil engineering.

MODULE I REMOTE SENSING 09

Concepts of remote sensing- energy sources and radiation principles-energy interactions in the atmosphere- spectral reflectance of earth surface features-concepts of microwave remote sensing- visual interpretation-digital image processing- image preprocessing- image enhancement-image classification-remote sensing satellites

MODULE II BASIC CONCEPTS OF GIS 09

Basic concepts and components- hardware, software-spatial and non-spatial data- geo referencing- map projection- types of projection- simple analysis-data retrieval and querying-data input

MODULE III DATA STRUCTURES AND ANALYSIS 09

Data base- data base models- raster and vector data structures- Topology-GIS modeling- Raster and Vector data analysis- Buffering and overlaying techniques-DEM TIN and DTM- network analysis- output devices, errors, types of errors.

MODULE IV APPLICATIONS IN TRANSPORTATION MANAGEMENT 09

Highway and railway alignment, location of transport terminals, and road side facilities, bus stops, route optimization, accident analysis-Integration of GIS, GPS, and remote sensing techniques, Advanced traveller information system and automatic vehicle location system.

MODULE V APPLICATIONS IN WATER AND ENVIRONMENT MANAGEMENT 09

GIS in watershed management, Irrigation management, drought management, flood management, waste land management- management and monitoring of environment-conservation of resources.

Total Hours: 45

REFERENCES:

1. Burrow P.A.,Principles of GIS for Land Resources Assessment, Oxford Publication, 1994.
2. Marble D.F., CalkinsH.W and Penquest, Basic readings in GIS, Speed System Ltd, New York, 1984.
3. Lillisand T.M , Kiefer R.W., Remote sensing and image interpretation, John Wiley and Sons, New york, 2004.
4. C.P.Lo , Yeung, A.K.W, Concepts and technologies of Geographic Information systems, Prentice Hall India, New Delhi, 2004

OUTCOME:

At the end of the course the student will able to

- identify the energy sources and its target interactions, to be interpreted in a satellite image.
- enhance the satellite image to increase its interpretability of the target features.
- identify the projection suitable for different applications and to generate queries to solve real world problems.
- design GIS data structure to incorporate real world as a system component and to perform spatial queries.
- describe real world problem in transportation and to justify the solutions arrived technically.
- identify problem with respect to water and environmental management and to solve the problems using GIS and remote sensing techniques.

CECY126	URBAN PLANNING AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge on urban planning, zoning rules and regulations, architectural design and implementation of management information system in urban planning.

MODULE I INTRODUCTION 08

Definition of terms –trend of urbanization at international, national, state and district levels .national and regional development policies and strategies – urbanization, housing and transportation sustainable urban development-definition and principles.

MODULE II PLANNING PROCESS 09

Types of urban and regional plans, stages in the planning process – delineation of planning areas, goals and objectives of plans, surveys and analysis, formulation of plans, evaluation of alternative plans, plan implementation, legal, financial and institutional constraints in the planning process .social orientation in the planning process.

MODULE III DEVELOPMENT MANAGEMENT SYSTEMS 09

Development control rules – zoning regulations, sub divisional regulations, building bye-laws, co-ordination between urban local bodies and other functional agencies such as water supply & sewerage boards, housing boards including slum boards and planning authorities

MODULE IV SMART CITIES 10

The Origins of smart cities - municipal information systems - gis and interoperability - confidentiality, privacy, the surveillant society - the next generation of sensors - opportunistic data: generated for one purpose, used for another - integrating data, open data - coordinating services, emergency response and location-based services - web mapping, real time sensing and information - making cities smarter, coupling networks, services and people, - new forms of electronic community.

MODULE V MANAGEMENT INFORMATION AND DECISION SUPPORT 09

Database, management information system, decision support system for land suitability, urban renewal and network analysis.

Total Hours: 45

REFERENCES:

1. Master Plans for Cities and Towns prepared by Planning Authorities, Chennai Metropolitan Development Authority, 1995.
2. Development Control Rules for Chennai Metropolitan Area, CMDA, Chennai, 2004.
3. Rangwala S C, Town Planning, Charotar Publishing House, 2009.
4. Francis D.K.Ching Architecture: Forms, space and order , VNR, New York,2014.

OUTCOME:

At the end of the course the student will be able

- define the concept of urbanization and its trend in developed countries.
- create an plan using various stages of planning.
- describe the bye laws and the role of Urban Local Bodies and other functional agencies in urbanization
- define the concept of smart cities.
- manage the datas using various information systems.

CECY127	MATERIAL MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVE:

- To impart knowledge on classification, procurement, store management of materials, and methods of disposal of waste.

MODULE I INTRODUCTION 08

Material classification- organizing for materials management – basis for forming organizations – conventional and modern approaches to organizing materials management. materials identification – classifying of materials – codification of materials – standardization – simplification and variety reduction of materials – integrated material management

MODULE II MATERIAL PROCUREMENT 10

Material purchasing– planning purchasing materials – norms of vendor rating – cei methodology – material selection and development – purchasing procedures and methods – legal aspects – insurance of materials - supply management – sources of supply – out sourcing material management- procurement organization - procurement planning – functions of material management - inventory control.

MODULE III STORE MANAGEMENT 06

Storing of materials-management of stores – location – different types of stores – methods of storing – safety and security of materials – stores equipment – materials handling equipment – factors affecting materials handling

MODULE IV WASTE MANAGEMENT 06

Scrap & Obsolete Materials-Management of surplus obsolete and scrap materials – reasons for accumulation of surplus obsolete and scrap materials – methods of disposal – regulations and procedures

Total Hours : 30

REFERENCES

1. 1. A.K. Datta, “Materials Management: Procedures, Text and Cases”, PHI Learning Pvt. Ltd.,2004.
2. 2. Arnold, “Introduction To Materials Management”, Pearson Education India,2009

3. 3. Richard J. Tersine, “Principles Of Inventory And Materials, Management”, Prentice Hall,2004
4. 4. Richard J. Tersine, “Modern Materials Management”, John Hardin Campbell - 2007
5. 5. P. Gopalakrishnan, “Handbook of Materials Management”, PHI Learning Pvt. Ltd.2004

OUTCOME:

At the end of the course the student will be able to

- categorize and classify the various materials.
- describe the purchase procedure of materials.
- analyse the supply and outsourcing of material management.
- describe the safety and security of material storage.
- analyse the management of scrap and obsolete materials.

CECY128 CONSTRUCTION SAFETY MANAGEMENT L T P C
2 0 0 2

OBJECTIVE:

To impart knowledge in

- Safety aspects involved in construction industry.
- Policies followed and awareness in construction industry.

MODULE I INTRODUCTION 08

Construction Safety Management – OSHO - Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety monitoring. Writing safety manuals, preparing safety checklists and inspection reports.

MODULE II SAFETY IN DIFFERENT OPERATIONS 08

Safety in construction operations – Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety measures. Safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms. Safety while using electrical appliances. explosives used.

MODULE III SAFETY AWARENESS 07

Various safety equipment and gear used on site. First aid on site, Safety awareness program. Labor laws, legal requirement and cost aspects of accidents on site, Incentive for safety practices.

MODULE IV SAFETY POLICY 07

Study of safety policies, methods, equipment, training provided on any ISO approved construction company, safety in office, working on sites of high rise construction, deep excavation

Total Hours: 30

REFERENCES:

1. Construction safety manual – SP 70 published by National Safety Commission of India- 2007.
2. Safety Management in Construction Industry – A manual for project

managers. NICMAR Mumbai, 1998.
3. Construction Safety Handbook – Davies V.S.Thomasin K, Thomas Telford, London, 1990.
4. Construction Safety Management Tim Howarth, Paul Watson, Wiley-Blackwell, 2008.

OUTCOME:

At the end of the course student will be able to

- define the roles and responsibilities of stakeholders in establishing safety in the project.
- describe the safety practices to be followed during various construction operations.
- state the awareness about safety in site.
- analyse the safety policies followed by organization in construction site.

CECY129	TRANSPORTATION PLANNING AND MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVE:

To impart knowledge on

- various transportation systems
- methods of demand forecasting, route choice modeling and transportation management

MODULE I TRANSPORTATION SYSTEMS 06

Systems approach to transport planning – interdependence of the land use and traffic– stages in transportation planning – transport planning considerations travel forecasting process – statutory land use planning process – planning issues

MODULE II TRANSPORTATION INVENTORIES & TRAVEL DEMAND FORECASTING 08

Concepts of zoning – methods of transportation surveys – inventory of transport and other activities – planning studies and methods – development of planning process conventional modeling process – four stage modeling processes – trip generation models – trip distribution models and calibration – advancement in trip end modeling

MODULE III ROUTE AND MODE CHOICE MODELING 08

Methods of trip assignment models – multi modal trip assignment – mode choice and modal split models – advancement in route choice and mode choice modeling

MODULE IV LAND USE TRANSPORT MODEL (LUT) 08

Accessibility measures and basic theories – lowery derivatives model- garim model – Basics of systems approach in LUT Model- classification of land use models – intercity travel demand models – transit planning and services.

Total Hours: 30

REFERENCES:

1. Jotin Khisty C, Kent Lall B, Transportation Engineering – An Introduction, Third Edition, Prentice Hall of India, New Delhi, 2002.
2. Papacostas C.S., Prevedouros, Transportation Engineering and Planning,

Third Edition, Prentice Hall of India, New Delhi, 2002.
3. John D.Edwards (Edr.), Transportation Planning Hand Book, Second Edition, Institute of Transportation Engineers, Prentice Hall Inc., Washington DC, USA, 1999.
4. John W Dicky, Metropolitan Transportation Planning – A Decision Oriented Approach, McGraw Hill, New York, 1984.
5. O'Flaherty C.A, Transport Planning and Traffic Engineering, Elesevier Publications, New Delhi, 1997.

OUTCOME:

At the end of this course the student will be able to

- identify the stages of transportation planning.
- design and forecast the travel demand.
- identify the Advancement in Route Choice and Mode Choice Modeling.
- analyse the land use transport model.
- categorize the various transportation management system.

CECY130	LEAN CONSTRUCTION	L	T	P	C
		1	0	0	1

OBJECTIVE:

To provide knowledge on

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I LEAN PRINCIPLES 05

Historical Background – WIP – cycle time – little's law –queuing theory – lean production systems principles

MODULE II LEAN CONSTRUCTION 05

Issues with contemporary CM/PM practices – Lean Construction as Project production system – EZ strobe - lean construction Principles –TFV views on production

MODULE III LEAN PROJECT DELIVERY SYSTEM 05

Improving production design & planning – lean work structuring - improving project control: last planner system - improving design management – improving project delivery

Total Hours: 15

REFERENCES:

1. Liker, J. K., and Meier, D. (2005). The Toyota Way Fieldbook, McGraw-Hill, New York, NY. 476 pp.
2. Readings at http://www.leanconstruction.org/readings.htm
3. Liker, J. K. (2004). The Toyota Way, McGraw-Hill, New York, NY. 330 pp.
4. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOME:

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

- summarize the lean principles.
- explain the Lean construction principles and apply lean principles to a small construction project.
- demonstrate the Lean construction project delivery system

CECY131	SITE INVESTIGATION AND SOIL EXPLORATION TECHNIQUES	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To familiarize the students with various site investigation programme, geotechnical terminology and important concepts

MODULE I SUB SURFACE EXPLORATION TECHNIQUES 07

Necessity of soil sampling -Methods of soil exploration- Direct method of exploration-Auger Boring-Wash Boring - Percussion boring-Core Drilling-Rotary Boring Indirect method of exploration –Geo physical method- Electrical resistivity method – Advantages - Sectional map-Location of ground water basin Sampling Techniques -Disturbed Sample -Undisturbed Sample - thin walled sampler- Split Spoon Sampler-Core Cutter-Area ratio-Core Recovery ratio

MODULE II DEEP EXPLORATION 08

Deep Boring-rock core drilling-Preservation of borelogs- Techniques for deep boring-Water test - Standard Penetration test-Limitations -Advantages- Static cone penetration test-Vane Shear test-Plate load - test- Cyclic plate load test - Pressure meter-subsoil - deformation test-Field Density.

Total Hours : 15

REFERENCES:

1. Tomlinson, M.J. and Boorman. R., Foundation Design and Construction, ELBS Longman, 6th edition, 2013.
2. Nayak, N.V., Foundation Design manual for Practicing Engineers, Dhanpat Rai and Sons, 2012.
3. Winterkorn H.F and Fang H.Y., Foundation Engineering Hand Book, Van Nostrard – Reinhold, 1991.
4. Braja M. Das, Principles of Foundations Engineering, Thomson Asia (P) Ltd., 2012.
5. Bowels J. E., Foundation Analysis and Design, Mc Graw-Hill International Book Co., 1996.

OUTCOME:

At the end of the course students will be able to

- interpret subsurface information to report soil properties

- determine bearing capacity and settlement.

CECY132	AIR QUALITY MODELING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce the fundamentals of air pollution with a background on historical perspective on air pollution.
- To introduce the theory of dispersion of air pollution in the atmosphere.
- To discuss the major approaches for air pollution modeling
- To demonstrate the features and the use of most widely used commercial and freely available air quality models

MODULE I MODELING CONCEPT 8

Overview of different types of models-deterministic and stochastic approach- Steps in model development- numerical and simulations models- calibration and validation of models- Limitations- Transport phenomena- Mass balance analysis- Model development and decision making.

MODULE II AIR POLLUTION MODELING 11

Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution –Transport of air Pollutants - Meteorological settling for dispersal of air pollutants – Vertical structure of temperature and stability, atmospheric motions, Wind and shear, self cleaning of atmosphere; transport and diffusion of stack emissions – atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.

MODULE III AIR QUALITY MODELS 12

Types modeling technique, modeling for nonreactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models- diffusion models – Gaussian plume derivation- modifications of Gaussian plume equation- long term average-multiple cell model- receptor oriented and source oriented air pollution models- model performance, accuracy and utilization-air Quality Index -air quality mapping

MODULE IV INDOOR AIR QUALITY MODELS 8

Indoor Air Pollutants - Volatile Organic Compounds , Inorganic Gaseous Pollutants Respirable Particulates ,Bioaerosols, Radon and its decay products-Infectious disease transmission- A/C units in indoor- Odours and sick building syndrome- Indoor Air quality Models.

MODULE V SOFTWARE PACKAGE APPLICATIONS 6

Commercial air quality models -ADMS, Airviro and USEPA models.

Total Hours : 45

REFERENCES:

1. 1. Zanneti, P. "Air Pollution Modeling Theories", Computational Methods and Available Software. Van Nostrand Reinhold, New York. 1990
2. Boubel R.W., Fox D.L., Turner D.B & Stern A.C., "Fundamentals of Air Pollution" Academic Press, New York, 1994
3. Schnoor J.L., "Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil", John Wiley & Sons Inc., New York, 1996.
4. Arthur C.Stern Air Pollution (3rd Ed.) Volume I – Air Pollutants, their transformation and Transport, (Ed.), Academic Press, 2006.
5. Deaton and Wine Brake, “Dynamic Modeling of Environmental Systems”, Wiley & Sons, 2002.

OUTCOMES:

After the completion of this course, the student will be able to Develop conceptual schematics required for air quality modeling and an ability to translate pertinent criteria into air pollution control.

CECY133 RS and GIS for Environmental Engineering

L	T	P	C
3	0	0	3

OBJECTIVE:

To develop a basic knowledge about the Remote Sensing and GIS for environmental engineering and apply the same in the field application.

MODULE I ENVIRONMENT **9**

Water - Air-Land-Marine Environment Global Climatologic, urban Environment

MODULE II INTRODUCTION TO REMOTE SENSING **9**

Role of RS in different types of Environments - Air, Water, Land. GIS for-marine environment, urban environment

MODULE III CONCEPT OF GEOLOGY **9**

Introduction - spectral characteristics of water, soil, rock-water parameter, pollution studies

MODULE IV INTRODUCTION TO GIS **9**

GIS-introduction- role of GIS - data analysis- thematic maps preparation, modeling

MODULE V APPLICATION OF GIS **9**

GIS for - soil erosion- Land degradation- Ecology-degradation-Coastal marine studies water Quality, monitoring and management

Total Hours : 45

TEXT BOOKS:

1. Lintz, J. and Simonet, “Remote Sensing of Environment”, Addison Wesley Publishing Company, 2004.
2. Lilliesand, T.M. and Kiefer, R, W., “Remote Sensing and Image Interpretation”, John Wily and sons, 2004.

REFERENCES:

1. Burrough, P.A. and, McDonnell, R.A., “Principles of Geographical Information Systems”, Oxford University Press, 2009.

OUTCOMES:

At the end of this course, the students will explore the concepts about the Remote Sensing and GIS for environmental engineering and apply the same in the field application.

CECY134	TRANSPORTATION MODELING AND SIMULATION	L	T	P	C
		2	0	0	2

OBJECTIVE:

Offers basic and fundamental principles of Systems Approach and its application in simulating and modeling the complex and dynamic traffic and transportations systems

MODULE I SYSTEMS APPROACH CONCEPT 9

System –Concepts, Theories –Classification –Models –Concept of Modeling exercises -Phases in model building process –System Approach –System Dynamics (S.D) View Points –Physical Flow –Information Flow

MODULE II MODEL CONCEPTUALISATION 9

Causal Loop (CL) Diagramming –Diagramming Approach –Justification for links –Conceptualization and Development of Causal Loop Representations -Case Study examples in C.L diagramming in Transportation Planning –Principles of Systems and its Hierarchies

MODULE III MODEL DEVELOPMENT AND SCENARIO ANALYSIS 10

System Dynamic Model Development -Flow Diagramming methodologies –Stocks and Rate Variable Concepts –Relevance of selection in Level and other auxiliary variables –Significance of Sensitivity Analysis in Simulation Modeling –Importance of Policy and Scenario Analysis.

MODULE IV MODEL VERIFICATION AND VALIDATION 7

Concepts of Model Verification –Model Calibration –Model Validation -Sensitivity and Dimensional Analysis –Methods of SD Model Validation –Comparison of Conventional Model Validation with Simulation Model Validation efforts.

MODULE V MODELING TRANSPORTATION SYSTEMS 10

Conventional Modeling –Computer Simulation Modeling efforts –Application to Traffic and Transportation Systems –Modeling of any traffic systems for service quality enhancement –Modeling of transport, energy and environment system interactions

Total Hours –30

REFERENCES:

1. Pratab Mohapatra K.J.et al., "Introduction to System Dynamics Modeling", University Press, Hyderabad,1994

2. Thirumurthy A.M., "Environmental Facilities and Urban Development in India – A System Dynamics Model for Developing Countries, Academic Foundations, India,1992.
3. Nancy Roberts et al., "Introduction to Computer Simulation –A System Dynamics Modeling Approach", Addison –Wesley, London,1983
4. Papacostas C.S., Prevedouros, "Transportation Engineering and Planning", 3rdEdition, Prentice Hall of India, New Delhi,2002
5. John D.Edwards, Jr. P.E, "Transportation Planning Handbook, Institute of Transportation Engineers, Prentice Hall Publication, Washington D.C., USA,1999

OUTCOMES:

At the end of the course, students will be able to

- Understand the system approach concept
- prepare model conceptualization
- design and develop the model.
- Execute the model verification and validation
- Design the model transportation.

CECY135	REMOTE SENSING AND GIS IN TRANSPORTATION DEVELOPMENT	L	T	P	C
		2	0	0	2

OBJECTIVE:

Introduce the students, the recent techniques of Remote Sensing and GIS and Its application in Traffic and Transportation Engineering

MODULE I INTRODUCTION TO REMOTE SENSING 10

Definition –Components of Remote Sensing –Energy, Sensor, Interacting Body –Active and Passive Remote Sensing –Platforms –Aerial and Space Platforms –Balloons, Helicopters, Aircraft and Satellites –Electromagnetic Radiation –EMR Spectrum

MODULE II INTRODUCTION TO GIS 9

Basic Concept and Components –Hardware, Software –Data Spatial and non-spatial –Geo-referencing –Map Projection –Types of Projection –Simple Analysis –Data retrieval and querying

MODULE III DATA STRUCTURES AND ANALYSIS 9

Database –Raster and Vector data structures –Data storage –Run length, Chain and Block coding –Vector data storage –Topology –GIS Modelling -Raster and Vector data analysis –Buffering and overlaying techniques –Network Analysis –Spatial Analysis

MODULE IV BASIC APPLICATIONS IN TRANSPORTATION 8

Highway and Railway Alignment, location of transport terminals and roadside facilities, bus stops – Route optimization –Bus route rationalization –Accident analysis –Applications of Aerial Photography and Satellite Imageries

MODULE V ADVANCED APPLICATIONS IN TRANSPORTATION 10

GIS as an integration technology –Integration of GIS, GPS and Remote Sensing Techniques – Advanced Traveler Information System (ATIS) –Automatic Vehicle Location System (AVLS)

Total Hours –30

REFERENCES:

1. Anji Reddy, "Remote Sensing and Image Interpretation", John Wiley and Sons Inc. New York, 1987.
2. M.G.Srinivas, "Remote Sensing Applications", Narosa Publishing House, 2001.
3. Burrough P.A, "Principles of GIS for Land Resources Assessment", Oxford

Publication, 1994.

4. Jeffrey Star and John Ester, Geographical Information System –An Introduction, Prentice Hall Inc., Englewood Cliffe, 1990.
5. Marble, D.F, Calkins, H.W and Penquest, Basic Readings in GIS, Speed System Ltd., New York, 1984.

OUTCOMES:

At the end of the course, the students will be able to

- Understand the remote sensing
- Understand the importance of Spatial analysis
- Analyis the data structure.
- identify the basic application in transportation
- identify the advanced application in transportation

LIST OF EVEN SEMESTER ELECTIVES

CECY221	CONSTRUCTION QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge in

- quality planning, assurance and improvement techniques.
- Statistical control and standards in construction industry.

MODULE I QUALITY MANAGEMENT 09

Introduction – definitions and objectives – factor influencing construction quality - responsibilities and authority - quality plan - quality management guidelines – quality circles.– requirements – preparing quality system documents – quality related training – implementing a quality system – third party certification.

MODULE II QUALITY PLANNING ASSURANCE AND CONTROL 09

Quality policy, objectives and methods in construction industry - taguchi's concept of quality – codes and standards – documents –– inspection procedures - Total QA / QC programme and cost implication- techniques and needs of QA/QC - different aspects of quality – appraisals- critical, major failure aspects and failure mode analysis

MODULE III QUALITY CONTROL AND IMPROVEMENT TECHNIQUES 09

Quality improvement - selection of new materials - influence of drawings, detailing, specification, standardization - bid preparation - quality checklist in sites - masonry- plastering-concrete construction- batching, mixing, transporting, placing, compaction, finishing, curing - reinforcement work - formwork - timber & steel construction, - doors & windows, - plumbing & drainage - duties, responsibilities, qualification of staff in organization - purpose of inspection: inspection of various components of construction; reports and records;

MODULE IV STATISTICAL QUALITY CONTROL 09

Statistical quality control - quality measurement: attributes and variables - statistical process control (spc) methods - control charts for attributes - p-charts - proportion defective - c-charts - number of defects per unit - control charts for variables - other types of attribute-sampling plans acceptance sampling

MODULE V QUALITY STANDARDS 09

Quality standard codes from its application point of views- List important clauses with range of acceptable parameters related to quality of cement, bricks, steel and concrete as given in quality standards. Important provisions of Indian standards about different construction activities- ISO9000 and ISO14000 standards.

Total Hours: 45

REFERENCES:

1. Abdul Razzak Rumane, Quality Management in Construction Projects, CRC Press, 2010
2. James, J.o' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 2012.
3. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 2000.
4. Arora.K.C., ISO 9000 to OHAS 18001, S.K. Kataria & Sons; Reprint 2012 edition
5. Er. S.C. Basu Roy, Modern Concept of Total Quality Control and Management for Construction, Nabhi Publication (2013)

OUTCOME:

At the end of the course, students will be able to

- apply total quality management in civil construction.
- check the quality in civil construction works.
- improve the quality of construction.
- identify the variations in quality of civil works.
- use various standard codes in civil construction works.

CECY222	ENVIRONMENTAL IMPACT ASSESSMENT OF INFRASTRUCTURE PROJECTS	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart the knowledge about

- the need of civil engineering professionals to be acquainted with the potential environmental risks of infrastructure projects.
- methods of qualitative and quantitative assessments, environmental risk evaluation, risk management and remediation techniques.

MODULE I INTRODUCTION 06

Environmental impact assessment (EIA), definitions and concepts, rationale and historical development of EIA, EIA in civil engineering, initial environmental examination, environmental appraisal, environmental impact factors and areas of consideration, measurement of environmental impact, Status of EIA in India, types and limitations of EIA

MODULE II EIA: PROCESSES AND PROCEDURES 10

Components of EIA – methods, techniques & procedure for EIA – processes – screening- scoping- setting- analysis- mitigation. matrices- networks – checklists – connections and combinations of processes - cost benefit analysis – analysis of alternatives – expert systems in eia - environmental impact statement. Technical components of environmental impact assessment - case studies -water resources, water quality, and land resources - land use, ecology and wetlands - traffic and transportation - waste management and hazardous materials.

MODULE III SOCIO-ECONOMIC IMPACT ASSESSMENT 09

Prediction tools for EIA – mathematical modeling for impact prediction – assessment of impacts – air – water – soil – noise – biological —- socio-cultural environments -cumulative impact assessment – documentation of eia findings – planning – organization of information and visual display materials – report preparation.

MODULE IV ENVIRONMENTAL MANAGEMENT 10

Environmental management - principles, problems and strategies; environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes; review of political, ecological and remedial actions; future strategies; multidisciplinary environmental strategies, the human, planning,

decision-making and management dimensions; environmental planning and the future of EIA - ethical and quality aspects of environmental impact assessment.

MODULE V ENVIRONMENTAL AUDIT, LIFE CYCLE ASSESSMENT & STANDARDIZATION 10

Environmental audit - definitions and concepts, partial audit, compliance audit, post project audit methodologies and regulations. life cycle assessment; triple bottom line approach; industrial ecology; ecological foot printing; carbon trading; sustainable development; introduction to ISO and ISO 14000; EMAS regulations; wider application of system based approach.

Total Hours: 45

REFERENCES:

1. Charles H. Eccleston , Environmental Impact Assessment: A Guide to Best Professional Practices, CRC Press, 2011.
2. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.
3. A. K. Shrivastava, Environmental Impact Assessment, APH Publishing, 2003.
4. R. R. Barthwal, Environmental Impact Assessment, New Age International, 2002.

OUTCOME:

Upon successful completion of this course, the student will be able to

- understand factors, status, measurement and limitations of an EIA
- classify the components and explain the methods and procedures of an EIA
- appreciate specific methods and tools used in EIA for prediction and assessment
- plan the environmental management policy for multi-disciplinary environmental strategies
- execute an environmental audit and life cycle assesment.

CECY223 FINANCIAL ACCOUNTING & MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide conceptual knowledge on Accounting
- To prepare Financial Statement like Trading Account, P & L Account, Balance Sheet, and Fund flow & Cash flow statements with specific reference to construction industry
- To understand the Financial Statement s & Analyse the same
- To prepare certain functional budgets
- To apply marginal costing technique for managerial decision making

MODULE I INTRODUCTION TO ACCOUNTING 04

Introduction to accounting - meaning of accounting, branches of accounting, objectives of accounting -fundamental concepts-principles and rules of accounting

MODULE II FINANCIAL ACCOUNTING 12

Basic accounting cycles -journal, ledger and trial balance – preparation of trading account, profit and loss account, balance sheet – ratio analysis

MODULE III CASH FLOW AND FUND FLOW 08

Cash flow statement, meaning and concepts of fund flow & cash flow, difference between fund flow statement and income statement. preparation fund flow & cash flow statement

MODULE IV BUDGETS 09

Types of budgets-techniques for budgeting, preparation of cash budget and flexible budget

MODULE V COST ACCOUNTING 12

Cost - meaning and objective, elements of cost - marginal costing - cost-volume profit analysis- breakeven point. Application of marginal costing techniques to managerial decision making

Total Hours: 45

REFERENCES

1. Maheswari S. N., Suneel K Maheswari and Sharad K Maheswari, “A Text Book of Accounting for management”, Vikas publishing house pvt. Ltd., Noida, 2013
2. Shashi K Gupta and Sharma R K, “ Management Accounting – Principles and practice”, Kalyani publishers, Ludiana, 2013
3. Reddy T S and Murthy A, “Financial Accounting” Margham Pucblications, 2012
4. S.P. JainJain and K.L. Narang, “Cost Accounting Principles and Practice” Kalyani publishers, 2012

OUTCOME

At the end of the course the students will be able to

- understand the different branches of accounting and the principles governing accounting
- prepare trading, profit & loss account, balance sheet and also to analyse the financial statement.
- Prepare cash flow and fund flow statements for a company.
- understand as well as prepare cash budget and flexible budget for a concern.
- apply marginal costing techniques in managerial decisions

CECY224	GREEN BUILDING AND ENERGY EFFICIENT STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart the knowledge on

- design of energy efficient buildings which balances all aspects of energy lighting.
- space conditioning
- ventilation by providing a mix of passive solar design strategies
- use of materials with low embodied energy.

MODULE I INTRODUCTION 09

Energy required for building construction - heat transfer – measuring conduction –thermal storage – measurement of radiation – the green house effect – psychrometry chart – measuring latent and sensible heat. thermal comfort – site planning and development – temperature – humidity – wind – optimum site location sun protection – types of shading devices – conservation – heating and cooling loads - igbc's rating systems - sustainable sights - water efficiency - energy efficiency - materials and resources - indoor environmental quality.

MODULE II PASSIVE SOLAR HEATING AND COOLING 09

General principles of passive solar heating – key design elements - direct gain trombe walls, water walls, convective air loops – concepts – case studies – general principles of passive cooling – ventilation – predicting ventilation in building-window ventilation calculations - radiation – evaporation and dehumidification–mass effect–load control – air filtration and odour removal – heat recovery in large buildings

MODULE III DAYLIGHTING AND ELECTRICAL LIGHTING 09

Materials, components and details - insulation – optical materials – radiant barriers glazing materials - day lighting – sources and concepts – building design strategies – case studies – electric lighting –light distribution – electric lighting control for day lighted buildings – illumination requirement – components of daylight factor – recommended daylight factors – day lighting analysis – supplementary artificial lighting design

MODULE IV HEAT CONTROL AND VENTILATION 09

Requirements – heat transmission through building sections – thermal performance of building sections – orientation of buildings – building

characteristics for various climates – thermal design of buildings influence of design parameters – mechanical controls – examples. ventilation – requirements – minimum standards for ventilation – ventilation design – energy conservation in ventilating systems – design for natural ventilation.

MODULE V DESIGN FOR CLIMATIC ZONES 09

Energy efficiency – an overview of design concepts and architectural interventions – energy efficient buildings for various zones – cold and cloudy – cold and sunny – composite – hot and dry – moderate – warm and humid – case studies of residences, office buildings and other buildings in each zones – energy audit – certification.

Total Hours: 45

REFERENCES:

1. Moore F., Environmental Control system, Mc Graw Hill Inc., 1994.
2. Brown, GZ Sun, Wind and Light: Architectural design strategies, John Wiley,1985.
3. Cook. J, Award –Winning passive Solar Design, Mc-Graw Hill, 1984.

OUTCOME:

At the end of the course, the students will be able to

- identify the required energy for building construction.
- design and analyse the passive solar cooling and heating techniques.
- identify the required amount of daylight and electrical lighting for a building.
- analyse the ventilation and thermal design of a building.
- design a specific type of building for special climatic zones.

CECY225	GREEN CONCEPTS IN BUILDING ENVIRONMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart the knowledge on Green buildings concept ,indoor environment quality and economics of green building

MODULE I DEFINING "GREEN" AND "SUSTAINABILITY" 06

Green Design – concepts and definitions - sustainability begins with climate - recent upsurge in the green building movement -incentives for building green - incentives and tax deductions-green building programs -defining sustainable communities- emerging directions- liability - spectacular landmarks

MODULE II DESIGN STRATEGIES AND THE GREEN DESIGN PROCESS 10

Conventional versus Green Delivery Systems- green design strategies- The Integrated Design Process (IDP) -the green-building project delivery process- the integrated multidisciplinary project team - design process for high-performance buildings -sustainable site selection-general considerations- site selection - development density and community connectivity -brownfield redevelopment - alternative transportation -site development –storm water design-heat-island effect - light-pollution reduction -commissioning process -overview -fundamental commissioning –retro commissioning -enhanced commissioning -cost management

MODULE III GREEN MATERIALS AND PRODUCTS 10

General- green building materials - natural versus synthetic - storage and collection of recyclables- low-emitting materials -adhesives, finishes, and sealants -paints and coatings- flooring systems- earthen building materials- windows - miscellaneous building elements- roofing – wood - concrete - building and material reuse - building reuse -materials reuse- construction waste management-recycled materials- regional materials- rapidly renewable materials- bamboo-cork - insulation- linoleum- straw-bale construction-wheat board - use and selection of green office equipment- certified wood- life-cycle assessment of building materials and products- life-cycle cost analysis- third party certification

MODULE IV INDOOR ENVIRONMENTAL QUALITY (IEQ) & WATER EFFICIENCY 10

IEQ- general overview - indoor environmental quality and factors affecting the indoor environment -indoor-air quality -thermal comfort -noise pollution -day lighting and daylight factor (df) -ventilation and filtration -building materials and finishes emittance levels- water efficiency and sanitary waste- general issues- waste-water strategy: water reuse/recycling water- efficient landscaping – innovative wastewater technologies -water-use reduction- construction waste management- water fixtures and conservation strategies- toilets - urinals –faucets -shower heads -baseline water-consumption calculations- retention ponds, bio swales, and other systems

MODULE V ECONOMICS OF GREEN DESIGN 09

General Overview - costs and benefits of green design- the economic benefits of green buildings - cost considerations- life-cycle costing -life-cycle cost method - increased productivity - improved tenant/employee health -enhancement of property value and marketability - other indirect benefits external economic effects - increased recruitment and retention -tax benefits -miscellaneous green-building costs -energy costs- operation, maintenance, and repair costs - replacement costs - other costs - design and analysis tools and methods - present-value analysis - sensitivity analysis -breakeven analysis - computer programs - relevant codes and standards - liability issues - general overview - traditional litigation: pretrial and trial procedures -alternative dispute resolution

Total Hours :45

REFERENCES:

1. “LEED - Practices, Certification andAccreditation Handbook”. Sam kubba Ph.D., LEED AP
2. “Alternative Building Materials and Technologies”. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao New Age International, 2007.
3. “ Low Energy Cooling For Sustainable Buildings”. John Wiley and Sons Ltd, 2009.

OUTCOME:

At the end of the course, students will able to

- identify the basic concepts in green and sustainability.
- design and implement green building concepts in high rise buildings.
- identify various green materials and products in construction.

- analyze the indoor environmental quality and water efficiency of building.
- design the perform economic analysis of a green building.

CECY226	INFRASTRUCTURE PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- basic understanding of Infrastructure's impact on development of a country
- status of various sectors in Indian Infrastructure
- private Sector participation in infrastructure models
- infrastructure planning
- problems in infrastructure development and management

MODULE I BASIC CONCEPTS RELATED TO INFRASTRUCTURE. 09

Introduction to Infrastructure. -Power Sector - Water Supply and Sanitation Sector - Road, Rail, Air and Port Transportation Sectors - Telecommunications Sector - Urban Infrastructure - Rural Infrastructure - Special Economic Zones. - Organizations and Players in the field of Infrastructure. - The Stages of an Infrastructure. Project Lifecycle.- An Overview of Infrastructure Project Finance.

MODULE II PRIVATE INVOLVEMENT IN INFRASTRUCTURE 09

A Historical overview of infrastructure privatization. - the benefits -problems with infrastructure privatization - pre – requisites necessary to ensure success for switching over from public sector management to private sector management, issues in developing, funding and managing infrastructure projects, role, and responsibility of project management consultants. challenges in privatization of water supply - case study - challenges in privatization of power - privatization of road transportation infrastructure in india.

MODULE III CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION 09

Mapping and facing the landscape of risks in infrastructure projects.-economic and demand risks: political risks -socio-environmental risks – case study - cultural risks in international infrastructure projects- legal and contractual issues in infrastructure .challenges in construction and maintenance of infrastructure

MODULE IV STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION 09

Risk management framework for infrastructure projects - 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.

MODULE V INFRASTRUCTURE MANAGEMENT 09

Information technology and systems for successful infrastructure management - innovative design and maintenance of infrastructure facilities-infrastructure modelling and life cycle analysis techniques - capacity building and improving the governments role in infrastructure implementation - an integrated framework for successful infrastructure planning and management - infrastructure management systems and future directions.

Total Hours: 45

REFERENCES:

1. Alvin S. Goodman, P.E , Makarand Hastak, Infrastructure Planning Handbook Planning, Engineering, and Economics, ASCE Press, 2006.
2. Raghuram, G., Jain, R., Sinha, S., Pangotra, P., Morris, S., Infrastructure Development and Financing: Towards a Public-Private Partnership, MacMillan, 2000.
3. Weber, B., & Alfen, H.W., Infrastructure as an asset class - Investment strategies, project finance and PPP, West Sussex: John Wiley & Sons, 2010.

OUTCOME:

At the end of the course the students will be able to

- classify the various types of infrastructure systems, stages and players in the field.
- summarize the influence of private partnership in infrastructure development
- discover the various risks involved in the infrastructure projects
- develop a successful Infrastructure project implementation strategy
- recommend successful infrastructure management systems for a given condition

CECY227 SHORING, SCAFFOLDING AND FORMWORK

L	T	P	C
3	0	0	3

OBJECTIVE:

To impart knowledge on

- Planning of formwork, plant and site equipments required for formwork.
- Design and erection of forms for various elements such as slabs, beams, columns, walls, shells and tunnels.
- Advanced methods of form construction.

MODULE I PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK **09**

Introduction - forms for foundations, columns, beams and walls - general objectives of formwork building - planning for safety - development of a basic system - key areas of cost reduction - planning examples. Overall planning - detailed planning - labour requirement - costing - planning crane arrangements - site layout plan - transporting plant - formwork accessories.

MODULE II MATERIALS ACCESSORIES & PRESSURES **09**

Lumber - types - finish - sheathing boards working stresses - repetitive member stress - plywood - types and grades - jointing boarding - textured surfaces and strength - reconstituted wood - steel - aluminum - hardware and fasteners - nails in plywood - allowable withdrawal load and lateral load - pressures on formwork with examples.

MODULE III DESIGN OF FORMS AND SHORES **09**

Basic simplification - beam formulae - allowable stresses - deflection, bending - lateral stability - shear, bearing - design of wall, slab, beam and column forms - simple wood stresses - slenderness ratio - allowable load vs length behaviour of wood shores - form lining design tables for wall, slab and column formwork - slab props - rosett shoring - shoring tower - heavy duty props.

MODULE IV BUILDING AND ERECTING THE FORM WORK **09**

Carpentry shop and job mill - forms for footings – wall, column, sloped, strap and stepped footing - slab form systems - sky deck and multiflex - customized slab table - standard table module forms - swivel head and uniportal head - assembly sequence cycling with lifting fork - moving with table trolley and table prop. various causes of failures.

MODULE V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS 09

Hemispherical, parabolic, translational shells - forms for thin shell roof slabs design considerations - building the forms - placing concrete - forms removal - strength requirements -tunnel forming components - curb forms invert forms - arch forms - concrete placement methods - cut and cover construction, bulk head method - pressures on tunnels - continuous advancing slope method - slip forms – principles, types, advantages and functions of various components - planning - desirable characteristics of concrete - common problems faced - safety in slip forms - special structures built with slip form technique - types of scaffolds - putlog and independent scaffold, single pole scaffolds, truss suspended, gantry and system scaffolds.

Total Hours: 45

REFERENCES:

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996.
3. Michael P. Hurst, Construction Press, London and New York, 2003.
4. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw - Hill, 1996.
5. “Safety requirements for scaffolding”, American National Standards Institute, New York, 1994.

OUTCOME:

On completion of this course the students will be able to

- plan for the formwork accessories.
- identify the required materials and their properties of the formwork.
- design and construct formwork for various structural elements.
- built and erect formwork in different conditions.
- design formwork for domes, tunnels and scaffolds.

CECY228 AFFORDABLE HOUSING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on low cost housing technology and infrastructure services.

MODULE I HOUSING SCENARIO 09

Status of urban housing- status of rural housing. **Housing finance:** introducing-existing finance system in india- government role as facilitator- status at rural housing finance- impedimently in housing finance and related issues

MODULE II LAND USE AND PHYSICAL PLANNING FOR HOUSING: 09

Planning of urban land- urban land ceiling and regulation act- efficiency of building bye laws -residential densities. **Housing the Urban Poor:** living conditions in slums- approaches and strategies for housing urban poor.

MODULE III DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY 09

Adoption of innovative cost effective construction techniques- adoption of precast elements in partial prefabrication- adopting of total prefabrication of mass housing in india- general remarks on pre cast rooting/flooring systems- economical wall system- single brick thick loading bearing wall- 19cm thick load bearing masonry walls- half brick thick load bearing wall- fly ash, gypsum thick for masonry- stone block masonry- adoption of precast r.c. plank and join system for roof/floor in the building. alternative building materials for low cost housing: substitute for scarce materials- ferro cement- gypsum boards- timber substitutions- industrial wastes- agricultural wastes

MODULE IV LOW COST INFRASTRUCTURE SERVICES 09

Present status- technological options- low cost sanitation's- domestic wall- water supply energy. rural housing: introduction- traditional practice of rural housing continuous- mud housing technology- mud roofs- characteristics of mud- fire resistant treatment for thatched roof- soil stabilization- rural housing programs.

MODULE V HOUSING IN DISASTER PRONE AREAS 09

Earthquake- damages to houses- traditional houses in disaster prone areas type of damages and railways of non-engineered buildings- repair and restore action of earthquake damaged non-engineered buildings recommendations for future

constructions- requirement's of structural safety of thin precast roofing units against - earthquake forces- status of r&d in earthquake strengthening measures- floods- cyclone- future safety.

Total Hours : 45

REFERENCES:

1. Building materials for low –income houses – International council for building research studies and documentation.
2. Low-Cost Housing in Developing Countries, Guru Charan Mathur, Oxford & IBH Publishing Company, 01-Jan-1993
3. Goodman L J.Low Cost Housing Technology : East - West Perspectives, Pergatmon Press, 1981
4. Hand book of low cost housing - by A. K. Lal – Newage international publishers, 2003

OUTCOME:

At the end of the course, students will able to

- describe the scenario of low cost housing and its financing.
- create a plan for housing the urban poor.
- define the types of low cost housing technology used.
- state the services to be provided in low cost housing.
- identify the types of low cost house to be provided in different disaster prone areas.

CECY229 APPLICATION OF INFORMATION TECHNOLOGY IN INFRASTRUCTURE MANAGEMENT

L	T	P	C
1	0	2	2

OBJECTIVE:

- To impart knowledge on softwares and applications to manage Infrastructure.

MODULE I INTRODUCTION 08

Introduction to system hardware – languages – feasibility study and analysis – procurement, training, implementation and system management – procedural language - developing application with spread sheet -developing application with files and database software.

MODULE II BUILDING INFORMATION MODELING SOFTWARE 12

Introduction to BIM Software - application to enhance efficiency during and post construction phases, and facility management - applications like determination of quantities of items and material inventory - to build a building virtually prior to building it physically - work out problems and simulate and analyze potential impacts - anticipation and ease of project delivery, the overall safety of the project – introduction to navis works

MODULE III CONSTRUCTION ACCOUNTING 10

Accounting and cost engineering– enterprises – introduction to erp systems - operations simulation financial management- for use of tracking and developing the cost reports and issuing the change orders - computer applications – cash flow – case study

Total Hours: 30

REFERENCES:

1. Bily E. Gillet., Introduction to Operation Research - A Computer Oriented Algorithmic Approach, Tata McGraw Hill, 1990. Inc., 1999.
2. Paulson, B.R., Computer Applications in Construction, McGraw Hill, 2014.
3. Patti Feldman and William Feldman,Construction and Computers,McGraw Hill, 1996.

OUTCOME:

At the end of the course the student will be able to

- manage the database of a project/ organization using database softwares.
- define the application of BIM in construction industry.
- perform accounting using ERP softwares.

CECY230	COST ESTIMATION AND CONTROL	L	T	P	C
		2	0	0	2

OBJECTIVE:

To provide knowledge on

- Cost estimation
- Cost control

MODULE I ESTIMATING AND TENDERING 06

Introduction to estimating and tendering–estimation in large and small organizations- parties involved in estimating and tendering – estimating process – decision to tender –programming the estimate

MODULE II COST ESTIMATION 08

Collection and calculation of cost information – labor – materials – equipment – subcontractors – project study – preparing the estimates – types of estimates – site overheads – estimators reports – tendering adjustments.

MODULE III MANAGEMENT CONTRACT & USE OF SOFTWARE 08

Estimating in management contracting –management contractor's fee – use of estimating software – characteristics of estimating systems – methods of estimating – reports

MODULE IV BUDGETARY CONTROL 08

The Project budget–types of budget – classifications of costs – example of budgetary control - cost control problem – need for cash flow forecasting by contractors – requirements of a forecasting system - forecasting for activity cost control - control of project cash flows - relating cost and schedule information.

Total Hours: 30

REFERENCES:

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
3. Frank Harris & Ronald McCaffer with Francis Edum – Fotwe, Modern

Construction Management, Sixth Edition, Blackwell Publishing, 2006.
4. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

OUTCOME:

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

- summarize the estimating and tendering process of a project.
- explain the cost estimation process and also estimate a small construction project.
- demonstrate the use of estimation software.
- apply budget controls for a construction project.
- apply cost control techniques to monitor a construction project

CECY231	CONSTRUCTION RISK MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To impart the knowledge of risk management in construction projects.

MODULE I INTRODUCTION TO RISK MANAGEMENT 08

Definitions of risk - elements of risk management - causes of risk - components of risk management - planning for risk management – project charter – risk management policies, roles and responsibilities, examining stakeholder tolerance, risk management plan template – revisiting the work breakdown structure – risk management plan, creating the risk management plan, risk analysis, tracking.

MODULE II RISK IDENTIFICATION, RESPONSE AND COMMUNICATION 07

Identifying risk, preparing for risk identification, risk categories, referring to historical information – identifying the project risk – reviewing project documents, brainstorming, the delphi technique, analyzing swot – diagrammatic techniques - examining the results of risk identification, qualitative and quantitative risk analysis - preparing for risk response, creating risk response, results of risk response planning. risk monitoring and control - risk communication, informing public about risk and responding to expressed concerns, education.

Total Hours: 15

REFERENCES:

1. Bruce Barkley, Project Risk Management (Project Management), McGraw-Hill Professional, 2004
2. John R. Schuyler, Risk and Decision Analysis in Projects (Cases in project and program management series), Project Management Institute, 2002
3. Chris Chapman and Stephen Ward, Project Risk Management: Processes, Techniques and Insights, Wiley, 2003
4. Dale F. Cooper, Stephen Grey, Geoffrey Raymond, and Phil Walker, Project Risk Management Guidelines: Managing Risk in Large Projects and Complex Procurements, Wiley, 2004
5. James B. Atkins and Grant A. Simpson, Managing Project Risk: Best Practices for Architects and Related Professionals, Wiley, 2008

OUTCOME:

At the end of the course student will be able to

- define the risks in a project and its management.
- compute the risk mitigation strategies for a project.

CECY232	PROJECT MANAGEMENT FOR SMART CITIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give exposure to project management tools and techniques applicable for planning monitoring of smart infrastructure and smart cities.
- Enable to develop insight for managing project risks, uncertainties and complexities of smart cities project

MODULE I INTRODUCTION TO "SMART CITIES" & CONCEPT OF PROJECT MANAGEMENT 7

Introduction to smart cities – Philosophy – concept of project management – Phases, stages of project a- their approval status- work breakdown structure

MODULE II PROJECT ORGANIZATION STRUCTURE IN SMART CITIES 9

concept of project life cycle- the Organization Structure for projects in smart cities- Communication plan and its importance for project management- use of real options for project selection using software - , 'Options Thinking" and valuation of real options- role of software in in accepting / modifying the projects related to smart cities

MODULE III RESOURCES ALLOCATION AND LEVELLING IN SMART CITIES 9

work packages or activities for smart cities - scheduling of the activities in the smart cities - the estimation of activity durations- cost and resource required in smart cities - possible benefits and different alternatives – Line of balance Technique

MODULE IV RESOURCE SCHEDULING AND RISK MANAGEMENT FOR SMART CITIES 10

resource requirements consideration - Resource Smoothing Problem - the Resource Limitation problem for smart cities - aggressive estimation - Risk monitoring and control in smart cities - the Program Evaluation and Review Technique (PERT) model for smart cities - simulation approach

MODULE V PROJECT MANAGEMENT, MONITORING AND 10

CONTROL IN SMART CITIES

software development projects project development cycle- Monitoring and Control - the analysis of the status of the project in smart cities - Audit and Closure of projects - the staffing of the audit team, functioning of the team, data collection, analysis and reports for smart cities - a normal closure or a premature closure - the delivery of the output of the project, evaluation of the team as well as the project manager

Total Hours : 30

REFERENCES:

1. Harold Kerzner, PhD., 'Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 10th ed. John Wiley & Sons, Inc , march 2009.
2. Government of India. 2015. Smart Cities Mission Statement & Guidelines. New Delhi: Ministry of Urban Development; June. Available at: http://smartcities.gov. in/writereaddata/SmartCityGuidelines.pdf
3. Chitkara, K.K, (2014), Construction Project Management, 3 rd Edition, McGraw-Hill Publishing Company, New Delhi
4. Alison Dykstra (2011), Construction Project Management: A Complete Introduction, Kirshner Publishing, San Francisco, USA
5. Jimmie W. Hinze, (2013), Construction Planning and Scheduling, 4 th Edition, Pearson, New Delhi

OUTCOMES:

At the end of the course, the students will be able to

- Understand the concept of smart cities and project management
- Design the project organization structure in smart cities
- Identify the resources allocation and leveling in smart cities.
- identify the resources and risk management in in smart cities
- Execute the project management, monitoring and control in smart cities

CECY234	ADSORPTION AND KINETICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the principles of adsorption processes.
- To learn the basics of adsorption process design and operation.
- An ability to identify and address current and future environmental problems with help of adsorbents.

MODULE I ADSORPTION ON SURFACES 9

Development of adsorption science and technology, Forces and energies of adsoption, Adsorption equilibrium, Adsorption and potential energy curves, The Langmuir isotherm, The BET isotherm, BDDT classification of isotherms, Theories of adsorption equilibrium, Capillary pore condensation and hysteresis.

MODULE II ADSORBENTS AND CHARACTERIZATION 9

Commercial adsorbents, Novel adsorbents, Adsorbent characterization, Experimental procedures for measuring pore textural properties of porous media, Methods of regeneration- Thermal swing processes, Pressure swing processes, Displacement desorption

MODULE III DESORPTION KINETICS 9

Thermodynamic quantities and definitions, Temperature programmed desorption, Polanyi-Wigner desorption rate expression, Zero, first and second order desorption, Determination of heat of adsorption.

MODULE IV ADSORPTION AND CATALYSIS ON SURFACES 9

Nature of adsorbents on surfaces and catalytic action, Bonding and molecular geometries on surfaces, Langmuir isotherm and competitive adsorption, Unimolecular surface reactions, Bimolecular surface reactions, Structure sensitive and insensitive reactions, Ammonia synthesis - an example, Catalytic oscillatory reactions on surfaces, Single crystal model catalysts, Surface science approach to catalysis.

MODULE V APPLICATIONS OF ADSORPTION PROCESSES 9

Natural adsorbents – Availability and method of preparation Gas separation and

purification, Water treatment and air pollution control, Chromatographic separation of pharmaceutical ingredients.

Total Hours : 45

REFERENCES:

1. Physical Chemistry by P.W. Atkins.
2. Physical Chemistry - A Molecular Approach, D.A. McQuarrie and J.D.Simon.
3. Physical Chemistry of Surfaces by A.W. Adamson, A.P. Gast, Wiley.
4. Surface Science by Kurt W. Kolasinski, Wiley 2002.
5. Surface Chemistry and Spectroscopy by G. Ranga Rao, Ch.10 in Catalysis-Principles and Applications, Narosa 2002.

OUTCOMES:

Upon completion of the course students,

- Will be able to select suitable adsorbents and process
- Will be able to successfully carry out adsorption related research projects.

CECY235 ENVIRONMENTAL NANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide the knowledge in basics of nanotechnology.
- To identify and address current and future environmental problems with nanotechnology.

MODULE I GENERAL **9**

Background of nanotechnology, particle size and surface area, quantum dot. Converging science and technology, nanotechnology as a tool for sustainability, health, safety and environmental issues.

MODULE II ADSORBENTS AND CHARACTERIZATION **9**

Preparation of nano scale metal oxides, metals, CNT, functionalized nano porous adsorbents, nano composite- Chemical vapour deposition, sol gel, sonochemical, microwave, solvothermal, plasma, pulsed laser ablation, magnetron sputtering, electro spinning, Molecular immuring.

MODULE III CHARACTERISATION OF NANOMATERIALS **9**

AFM, STM, SEM, TEM, XRD, ESCA, IR & Raman, UV-DRS, of nanomaterials for structural & chemical nature.

MODULE IV OTHER FEATURES OF NANO PARTICLES **9**

Nanoparticle transport, aggregation & deposition. Energy applications-H storage.

MODULE V ENVIRONMENTAL APPLICATIONS **9**

Gas sensors, microfluidics and lab on chip, catalytic and photocatalyic applications, Nonmaterials for ground water remediation, nanomaterials as adsorbents,membrane process.

Total Hours : 45

REFERENCES:

1 Environmental applications of nanomaterials-Synthesis, Sorbents and Sensors, edited by Glen E Fryxell and Guozhong Cao, worldscibooks, UK

2 Environmental nanotechnology, Mark Wisener, Jeo Yues Bolteru, 2007, McGraw Hill.

3 The Chemistry of Nanomaterials, Synthesis, Properties and applications. Edited by C.N.R.Rao. Muller, A.K.Cheetham Copyright 8 2004 WILEY-VCH Verlag GmbH & Co.KGaA, Weinheim

4 Handbook of Nanotechnology, Edi-Bharat Bhushan, Springer, 2004.

OUTCOMES:

After completion of the course students will be able to

1. Demonstrate the knowledge in nano materials and nanotechnology..

2.Identify nano structured catalyst for water purification.

3.Fabricate and synthesis nano materials and apply nano technology for environmental engineering applications.

CECY236 ARCHITECTURE PEDAGOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

The architecture pedagogy research course work is the introduction of the scholar to the realm of architecture education & research. The objective is to expose them to the complexities of the education & pedagogical process of architecture research. To create an understanding of the role of various educational components and decision making processes; the contribution of related disciplines associated with the architecture pedagogy. The research will also explain the scholar with architecture pedagogical terminologies, methods of educational research.

MODULE I PRINCIPLE OF ARCHITECTURE DESIGN EDUCATION – I **9**

Architectural design process, interdisciplinary architectural thinking, Pattern language for design process.

MODULE II PHILOSOPHIES OF ARCHITECTURE DESIGN EDUCATION **9**

form & space in architecture, architectural theories for design development (Master architects philosophies for design process) etc.

MODULE III TRENDS OF DESIGN DEVELOPMENT **9**

Architecture styles & trends, Chronology of architectural development and style in Indian context.

MODULE IV ARCHITECTURE EDUCATION IN INDIAN CONTEXT **9**

Chronology of Architectural education India, Pedagogy of Architecture in India Education and Traditions in Indian educations

MODULE V LEARNING METHODS IN ARCHITECTURE EDUCATIONS **9**

Methods of Teaching architecture in India , Introduction to Learning Methods in architecture education

Total Hours : 45

REFERENCES:

1 Collin S.T., John Wilson, Architectural theory Volume

2 Mallgrave Harry et.al.(2009) Architectural theory Volume

3 Bronston Byron and Fang Eric (Ed) (1993), The Harvard Architecture Review Vol

4 Collin S.T., John Wilson, Architectural theory Volume

OUTCOMES:

Students will appreciate, understand and analyze contemporary conditions & concerning issues in architecture education, learn research techniques, assessing needs and prepare programming for design educational intervention.

GENERAL ELECTIVES

GECY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures

and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life –Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105	GAMING DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106	SOCIAL COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization –

Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development- Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water –Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities –

Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
    a. Modified Euler method
    b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. Laurene Fausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, “Java The Complete Reference”, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **“**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)”, John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, “Programming with Java”, 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, “**Let Us Java”, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database