B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2019

Curriculum and Syllabi

(Amendments updated upto July 2021)

M.Tech.
(Construction Engineering & Project Management)

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

REGULATIONS 2019
CURRICULUM AND SYLLABI
(Amendments updated upto July 2021)

M.TECH.
CONSTRUCTION ENGINEERING & PROJECT MANAGEMENT

VISION AND MISSION OF THE INSTITUTION

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.

DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION

VISION

To be a leading school for Education, Training and Research in Civil Engineering for a better future and over-all Socio-Economic progress of the Country in a sustainable manner

MISSION

- To nurture Civil Engineers into ethically strong and responsible leaders to address Global challenges through Quality Education, Application oriented research, innovation, inspiration, motivation and sustainable growth.

- To enrich and enhance knowledge for the best practices in various disciplines of Civil Engineering through Collaborations with Global Institutions of Excellence, Industries and Research Organizations.

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 life long learning.
- To function effectively with individual capabilities as well as with a collective strength as a professional team with good communication skills.

PROGRAMME OUTCOMES

On successful completion of the programme, the 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, research literature, and analyses 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 modeling 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

On successful completion of the programme, the graduates will

- 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.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY, CHENNAI – 600 048.
REGULATIONS - 2019 FOR

M.Tech. / MCA / M.Sc. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires **"Programme"** means Post Graduate Degree Programme (M.Tech. / MCA / M.Sc.)

"Course" means a theory / practical / laboratory integrated theory / mini project / seminar / internship / Project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.,

"Institution" means B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Academic Council" means the Academic Council, which is the apex body on all academic matters of B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Dean (Academic Affairs)" means Dean (Academic Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology who administers the academic matters.

"Dean (Student Affairs)" means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology, who looks after the welfare and discipline of the students.

"Controller of Examinations" means the Controller of Examinations of B.S. Abdur Rahman Crescent Institute of Science & Technology who is responsible for the conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	

2.2 ADMISSION REQUIREMENTS

2.2.1 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 Institution as specified in the clause 3.2 [Eligible entry qualifications for admission to P.G. programmes] or any other degree examination of any University or authority accepted by this Institution as equivalent thereto.

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

3.0 DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

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

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA (3 years)	6	12
MCA (Lateral Entry)	4	8
MCA (2 years)	4	8
M.Sc.	4	8

3.1.1 Each academic semester shall normally comprise of 90 working days. Semester End Examinations shall follow within 10 days of the last Instructional day.

3.1.2 Medium of instruction, examinations and project report shall be in English.

3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

Sl. No.	Name of the Department	Programmes offered	Qualifications for admission
1.	Aeronautical Engineering	M. Tech. (Avionics)	B.E. / B. Tech. (Aeronautical Engineering)
2.	Civil Engineering	M. Tech. (Structural Engineering)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering)

		M. Tech. (Construction Engineering and Project Management)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering) / B. Arch.
3.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. (CAD/CAM)	
4.	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 and Drives)	
5.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E. / B. Tech. (EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation)
		M.Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / E&I / I&C / EEE / CSE / IT)
6.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE/ICE/Electronics/ECE/EEE)
7.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
8.	Information Technology	M.Tech. (Information Technology)	B.E. / B. Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics / MCA)

9.	Computer Applications	MCA (3 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		MCA – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / BCA
		MCA (2 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA
10.	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study
11.	Physics	M.Sc.(Physics)	B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
12.	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
13.	Life Sciences	M.Sc. Molecular Biology & Biochemistry	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.Tech. Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

3.3. STRUCTURE OF THE PROGRAMME

3.3.1 The PG. programmes consist of the following components as prescribed in

the respective curriculum

i. Core courses
ii. Elective courses
iii. Laboratory oriented core courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Seminars
vii. Mini Project
viii. Industrial Internship
ix. Value Added Courses
x. MOOC Courses (NPTEL, SWAYAM, etc.,)

3.3.2 The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

3.3.3 For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

3.3.4 The curriculum of 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	Range of credits
M.Tech.	74 - 80
MCA (3 years)	118 - 126
MCA (Lateral Entry)	80 - 85
MCA (2 years)	85 - 90
M.Sc.	77- 82

3.3.5 Credits will be assigned to the courses for all programmes as given below:

- One credit for one lecture period per week or 15 periods of lecture per semester
- One credit for one tutorial period per week or 15 periods per semester
- One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester
- One credit for four weeks of industrial internship or 160 hours per semester.

3.3.6 The number of credits the student shall enroll in a non-project semester and

project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 28	18 to 26
MCA	12 to 33	12 to 26
M.Sc.	9 to 32	10 to 26

3.3.7 The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

3.3.8 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

3.3.9 Apart from the various elective courses listed in the curriculum for each specialization of programme, the student can choose a maximum of two electives from any other similar programmes across departments, during the entire period of study, with the approval of the Head of the department offering the course and parent department.

3.4. ONLINE COURSES

3.4.1 Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

3.4.2 Students shall undergo project related online course on their own with the mentoring of the faculty member.

3.5 PROJECT WORK / DISSERTATION

3.5.1 Project work / Dissertation shall be carried out by the student under the supervision of a Faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research Organization, with the approval of the Head of the Department/ Dean of School. 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 meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last Instructional day of the semester in which Project / Dissertation is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work / dissertation and shall re-register in the subsequent semester.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD / Dean of School 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 / Dean of School of the students shall 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 in every semester.

5.0 CLASS COMMITTEE

5.1 A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

5.2 The composition of the class committee will be as follows:

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester

iii) All the students of the class

iv) Faculty advisor and class advisor

v) Head of the Department – Ex officio member

5.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

5.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabus.

5.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

6.0 COURSE COMMITTEE

6.1 Each common theory / laboratory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers handling 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 handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

7.0 REGISTRATION AND ENROLLMENT

7.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

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

7.3 A student can withdraw from an enrolled course at any time before the first assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.4 A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

8.1 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. A student can avail the break of study before the start of first assessment test of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only in the subsequent year. The student availing break of study is permitted to write arrear examinations by paying the prescribed fees.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / 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.	18
MCA (3 years)	45
MCA (Lateral Entry)	22
MCA (2 years)	22
M.Sc.	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 ATTENDANCE

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds, representing for the institution 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. The courses in which the student is awarded "I" grade, shall register and redo the course when it is offered next.

10.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

10.3 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall redo all the courses of the semester in the subsequent academic year. However he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

10.4 A student shall register to redo 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 chosen with the approval of Head of the Department / Dean of School.

11.0 REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester in the evening after regular working hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters, without affecting the regular academic schedule

and not exceeding prescribed maximum credits.

11.2 The Head of the Department with the approval of Dean (Academic Affairs) may arrange for the conduct of a few courses in the evening after regular working hours, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

11.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

12.0 ASSESSMENTS AND EXAMINATIONS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightage of Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

12.2 Appearing for semester end theory examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However a student should have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.3 For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory component shall have a total of three assessments with two continuous assessments having 25% weightage each and semester end examination having 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination for the award of pass grade. The evaluation of practical component shall be through continuous assessment.

12.4 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.5 In the case of Industrial training, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research organisation. The weightage for Industry internship report shall be 60% and 40% for viva voce examination.

12.6 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the Viva Voce examination.

12.7 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be considered for grading along with the marks scored in the semester end arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination to award grades and the internal assessment marks secured during the course of study shall not be considered.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end arrear examination for theory component. There shall be no arrear or improvement examination for lab component.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc.

by a committee constituted by the Head of the Department / Dean of School for that purpose. However there is no substitute examination for semester end examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0 SUPPLEMENTARY EXAMINATION

14.1 Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semester.

15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET

15.1 All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

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

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevented from appearing for semester end examination

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

15.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

15.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department / Dean of School and it shall be declared by the Controller of Examinations.

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee to the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the i^{th} course and GP_i is the Grade Point in the i^{th} course

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

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

“I” and "W" grades are excluded for calculating GPA.

"U", “I”, "AB" and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks is as follows:

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period.
First Class	6.50 and above and completing the programme within a minimum prescribed period plus two semesters.
Second Class	Others

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 period of study and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the 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 is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall 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.

16.0 DISCIPLINE

16.1 Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

16.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

17.1 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.
iii. Enrolled and completed at least one value added course.
iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

17.2 The award of the degree must have been approved by the Institute.

18.0 POWER TO MODIFY

Not withstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

****

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

CURRICULUM & SYLLABI FOR

M. Tech. (Construction Engineering & Project Management)

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	MAD 6183	Probability and Statistics	3	1	0	4	
2.	CED 6121	Advanced Construction Planning, Scheduling & Control	3	0	0	3	
3.	CED 6122	Modern Construction Materials & Practices	3	0	0	3	
4.	CED 6123	Project Management in Construction	3	0	0	3	
5.	CED 6124	Contract laws & Regulation	3	0	0	3	
6.	CED 6103	Advanced Concrete Technology	3	0	2	4	
7.	CED 6125	Construction Management Lab	0	0	2	1	**21**
8		Value Added Course				0	

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	GED 6201	Research Methodology	3	1	0	4	
2.	CED 6221	Construction Economics, Finance & Risk Management	3	0	0	3	
3.	CED 6224	Construction Equipment Management	2	0	0	2	
4.	CED 6225	Building Information Modelling	0	0	2	1	
5.		Professional Elective*				9	
6.	CED 6223	Mini Project				1	**20**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C	
1.		Professional Elective**				6	
2.		General Elective				3	
3.	CED 7122	Internship***				1	
4.	CED 7121	Project Work (Phase I)	0	0	12	6	
5.		MOOC				0	
							10+6#

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	CED 7121	Project Work (Phase II)	0	0	36	18	**18**

Total credits – 75

* Students can select a maximum of 6 credits from one specialization from the list of electives

****** Students can select a maximum of 3 credits from one specialization from the list of electives

*** Industrial training will be undertaken during first year summer vacation for 30 days. The credit will be awarded in the 3rd Semester.

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

PROFESSIONAL ELECTIVES
II SEMESTER

INFRASTRUCTURE MANAGEMENT

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CEDY 221	Infrastructure Planning and Management	3	0	0	3
2.	CEDY 222	ICT Based Cities and smart infrastructure	3	0	0	3
3.	CEDY 223	Remote Sensing and GIS in infrastructure management	3	0	0	3
4.	CEDY 224	Rural Resources and Development Planning	3	0	0	3
5.	CEDY 225	Urban and Regional Planning	2	0	0	2
6.	CEDY 226	Sustainable Development	1	0	0	1

ENERGY MANAGEMENT

Sl. No.	Course Code	Course Title	L	T	P	C
7.	CEDY 230	Construction Demolition & Waste Management	3	0	0	3
8.	CEDY 231	Environment & energy for sustainable construction	3	0	0	3
9.	CEDY 232	Energy efficient structures	3	0	0	3
10.	CEDY 233	Green concepts in building environment	3	0	0	3
11.	CEDY 234	Energy Auditing	3	0	0	3

GENERAL MANAGEMENT

Sl. No.	Course Code	Course Title	L	T	P	C
12.	CEDY 240	Construction Accounting and Advanced excel	2	0	2	3
13.	CEDY 241	Personnel management	3	0	0	3
14.	CEDY 242	Safety Management	3	0	0	3
15.	CEDY 243	Quality Management	3	0	0	3
16.	CEDY 244	Shoring, scaffolding and formwork	3	0	0	3
17.	CEDY 245	CMDA Building Regulations & Approval	1	0	0	1

ADVANCED TOPICS

Sl. No.	Course Code	Course Title	L	T	P	C
18.	CEDY 250	Lean Construction	3	0	0	3
19.	CEDY 251	Management Information System	3	0	0	3
20.	CEDY 252	Automation in Construction	3	0	0	3
21.	CEDY 253	Value Engineering and Valuation	3	0	0	3
22.	CEDY 254	Pre Engineered Structures	3	0	0	3
23.	CEDY 201	Advanced Foundation Design	3	0	0	3

PROFESSIONAL ELECTIVES
III SEMESTER
INFRASTRUCTURE MANAGEMENT

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CEDY 121	Project Management in Smart Cities	3	0	0	3
2.	CEDY 122	Urban transportation infrastructure	3	0	0	3
3.	CEDY 123	Urban infrastructure and Network Planning	3	0	0	3
4.	CEDY 124	Urban sanitation and feacal sludge management	3	0	0	3
5.	CEDY 125	Integrated Rural development	2	0	0	2
6.	CEDY 126	Geo-Informatics for Urban / Rural management	1	0	0	1

ENERGY MANAGEMENT

Sl. No.	Course Code	Course Title	L	T	P	C
7.	CEDY 130	Intelligent Building Management	3	0	0	3
8.	CEDY 131	Sustainable Materials	3	0	0	3
9.	CEDY 132	Energy Modeling	1	0	2	2
10.	CEDY 133	Energy Rating	1	0	0	1

GENERAL MANAGEMENT

Sl. No.	Course Code	Course Title	L	T	P	C
11.	CEDY 102	Condition Assessment and Rehabilitation of Structures	3	0	0	3
12.	CEDY 140	Quantity Surveying	3	0	0	3
13.	CEDY 141	Fire Protection & Services	3	0	0	3
14.	CEDY 142	Logistics & Supply chain management	2	0	0	2

15.	CEDY 144	Post Disaster Management	1	0	0	1

ADVANCED TOPICS

Sl. No.	Course Code	Course Title	L	T	P	C
16.	CEDY 150	Advanced Techniques in construction	3	0	0	3
17.	CEDY 151	Airborne and terrestrial laser scanning system for buildings	3	0	0	3
18.	CEDY 152	Operations research & Decision theory	3	0	0	3
19.	CEDY 153	Lean Tools	2	0	0	2
20.	CEDY 154	Augmented Reality /Virtual Reality Applications in Construction	1	0	0	1
21.	CEDY 155	Wave Hydrodynamics	3	0	0	3

VALUE ADDED COURSE
II SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C
1)	CEDY 260	E Tabs	0	0	2	1
2)	CEDY 261	Revit Architecture	1	0	2	2

GENERAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GEDY 101	Project Management7	**3**	**0**	**0**	**3**
2	GEDY 102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GEDY 103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GEDY 104	Green Computing	**3**	**0**	**0**	**3**
5	GEDY 105	Gaming Design	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
6	GEDY 106	Social Computing	**3**	**0**	**0**	**3**
7	GEDY 107	Soft Computing	**3**	**0**	**0**	**3**
8	GEDY 108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GEDY 109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GEDY 110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GEDY 111	Programming using MATLAB& SIMULINK	**1**	**0**	**2**	**2**
12	GEDY 112	JAVA Programming	**3**	**0**	**0**	**3**
13	GEDY 113	PYTHON Programming	**3**	**0**	**0**	**3**
14	GEDY 114	Intellectual Property Rights	**1**	**0**	**0**	**1**
15	GEDY 115	Research and Publication Ethics	**2**	**0**	**0**	**2**

MAD 6183 PROBABILITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The course will impart knowledge on

- Probability distributions
- Testing of hypothesis and estimation theory.
- Simulations used in engineering.

MODULE I PROBABILITY DISTRIBUTIONS 10+3

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 9+3

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

MODULE III ESTIMATION THEORY 9+3

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

MODULE IV TESTING OF HYPOTHESIS 8+3

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 9+3

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

Total Hours –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. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Duxbury publication, 2007.
2. Jerry Banks, John S. Carson, Barry L. Nelson, "Discrete – Event systems Simulation", Prentice Hall India, New Delhi, 2001.
3. Lyman Ott .R, Michael Long Necker, "An Introduction to Statistical Methods and Data Analysis", 6th edition, Brooks/Cole Cengage Learning, USA, 2010.

OUTCOMES:

On completion of the course, students will be able to

- Identify and fit probability distribution for a given data.
- Solve two dimensional random variable problems
- Apply estimation theory
- Test hypothesis of statement
- Solve problems in modeling using simulation techniques.

CED 6121	ADVANCED CONSTRUCTION PLANNING SCHEDULING AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- planning construction projects
- scheduling the activities using network diagrams
- advanced scheduling techniques
- allocation & leveling of resources
- controlling the productivity of the project

MODULE I CONSTRUCTION PLANNING 9

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- Project scheduling levels - defining work tasks- work break down structure - coding systems

MODULE II SCHEDULING TECHNIQUES 9

Development of project network - AOA and AON diagrams - defining precedence relationships among activities - critical path method - construction schedules – scheduling calculations - float - scheduling for activity-on-node – PERT - scheduling with uncertain durations – PERT problems

MODULE III ADVANCED SCHEDULING TECHNIQUES 9

Use of advanced scheduling techniques – PDM – PDM Problems – LOB (Line of Balance) - BDM (Beeline Diagramming Method) network analysis for interdependent activities - DSM (Dependency Structure Matrix) modeling in projects

MODULE IV RESOURCE PLANNING 9

Resource Definition – Resource management – Resource allocation - Resource Aggregation (Loading) - Resource Leveling (Smoothing) - Method of Moments for Resource Smoothing- Heuristic Procedure for Resource Smoothing- Scheduling with Limited Resource – Monte Carlo schedule simulation- Queuing problems- Case Study

MODULE V CONSTRUCTION CONTROL 9

Project monitoring process - Project control process - Problems that may Arise during

Construction - Schedule Updating - Earned Value analysis - crashing and time/cost tradeoffs - Cost and Time forecasting problems

Total Hours – 45

TEXT BOOKS:

1. Baldwin .A & D. Bordoli, A Handbook for Construction planning and scheduling, Wiley publications, 2014
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 2014.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Mubarak.S, Construction Project Scheduling and Control, John Wiley publications, 2010

REFERENCES:

1. Eppinger .S.D & T.R. Browning, Design Structure Matrix Methods and Applications, MIT Press, 2012.
2. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.
3. James P. Lewis Project Planning, Scheduling, and Control: The Ultimate Hands-On Guide to Bringing Projects in On Time and On Budget Mc Grew Hill, New York, 2010.
4. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.

OUTCOMES:

On 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 constraints using advanced techniques.
- Resolve resource over allocation problems
- Control the productivity of construction projects.

CED 6122	MODERN CONSTRUCTION MATERIALS AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the properties of modern construction materials used in construction and their suitability of applications in construction industry.
- modern construction practices related to sub structure, super structure and prefabricated construction.

MODULE I METALS AND NON STRUCTURAL MATERIALS 9

Different types of steel, aluminum 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 9

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 – sensitive - electrified wood – flexi comb - self-repairing cement/concrete - liquid granite - bendable concrete – sustainable materials.

MODULE III SUBSTRUCTURE CONSTRUCTION 9

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 9

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, sustainable structures and dams.

MODULE V PREFABRICATED STRUCTURES 9

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

OUTCOMES:

On completion of the course, students 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.

CED 6123	PROJECT MANAGEMENT IN CONSTRUCTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course will impart knowledge on

- Project Life cycle
- Inception and feasibility study
- Construction phase
- Project delivery
- Project close out

MODULE I INTRODUCTION 8

Project - Relationships Among Portfolios, Programs and Projects -Project Management - Role of the Project Manager – Organizational structure - Project Stakeholders and Governance - Project Team - Project Life Cycle - Project Management Processes

MODULE II PROJECT FEASIBILITY & INCEPTION 9

Introduction, Significance in feasibility report- Technical analysis, Financial analysis, Economic analysis, Ecological analysis, Flow diagram for feasibility study of a project. Design Work Plan Producing Contract Documents Managing Scope Growth During Design Managing Small Projects, Project Team Meetings, Weekly Monthly Reports Drawing and Equipment Index - Distribution of Documents - Authority Responsibility Check List - Check List of Duties for Design Team Management - Evaluation of Design Effectiveness - Constructability Post Design Review

MODULE III PROJECT DELIVERY 10

Importance of Construction Assumptions for Construction Phase - Contract Pricing Formats - Design Bid Build Method of Project Delivery - Design Build Method of Project Delivery - Construction Management Method of Project Delivery - Bridging Project Delivery Method - Fast-Track Projects - Turn-Key Projects - Design Development and Performance Specifications - Key Decisions for Project Delivery - Number of Contracts Selection Criteria - Contractual Relationship - Terms of Payment - Prospective Bidders and Bidding Qualification Based Selection (QBS) Check List for Bidding - Keys to a Successful Project

MODULE IV PROJECT EXECUTION MANAGEMENT 9

Project Planning – Activity Relationship – Activity Duration - CPM - labor productivity - factors affecting job - site productivity - labor relations in construction - materials management - materials procurement and delivery- inventory control - construction equipment - choice of equipment and standard production rates – Equipment Productivity – Problems

MODULE V PROJECT CLOSE OUT 9

System Testing and Start-Up - Final Inspection Guarantee and Warranties - Lien Releases Record and As-Built Drawings - Check List of Duties - Disposition of Project Files - Post Project Critique - Owner Feed-Back

Total Hours –45

TEXT BOOKS:

1. Garold D. Oberlender, Project Management For Engineering And Construction, Second Edition, Mc Graw Hill, 2000
2. Project Management Body Of Knowledge (PMBOK®) Guide PMBOK, 5th Edition, 2013

REFERENCES:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 2014.
2. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
3. Frank Harris & Ronald McCaffer with Francis Edum – Fotwe, Modern Construction Management, Sixth Edition, Blackwell Publishing, 2006.

OUTCOMES:

On completion of the course, students will be able to

- define project life cycle and project management functions
- demonstrate and explain the various design and construction process
- outline the different delivery methods.
- Apply different techniques in execution.
- summarize the issues in closure of project..

CED 6124 CONTRACT LAWS AND REGULATIONS L T P C
3 0 0 3

OBJECTIVES:

The course will impart knowledge on

- various elements of contract, tendering procedures, arbitration.
- contract laws and regulations so that adequate knowledge on formulating and managing construction contracts is gained.
- labour regulations and other laws related to it.

MODULE I INTRODUCTION TO CONTRACTS 9

Definitions, Essentials for a legally valid contract, Salient features of a contract, Discharging of a contract, Documents for an Engineering Contract; Types of contracts: Classification Based on − Tendering Process, Economic Consideration, Tasks Involved; Main and Sub Contracts, Features, Merits, Demerits, Applicability of the various types of contracts.

MODULE II TENDERING PROCESS 9

Definitions, List of Documents, EMD, SD, Preparation of Enquiry Documents, Invitation for Tenders and sale of Documents, Preparation of Tender Documents and its submission, Receipt of Tender Documents and its opening, Evaluation of Tender and Award of contract – Letter of Award, Letter of Intent, Issues in tendering process: Pre - Registration, Pre – Qualification, Nominated Tendering, Rejection of Tenders, Repeat Orders, Revocation of Tenders, Unbalanced Bidding, Cartel or Collusion in Tendering.

MODULE III ADMINISTRATION/PERFORMANCE OF CONTRACT 9

Responsibilities (Duties and Liabilities) of Principal & Contractor, Monitoring and Quality control/assurance, Settlement of claims − Advances, Bills, Extension for time, Extras & Variations, Cost Escalations. Security Deposit, Retention Money, Performance Bond, Liquidated Damages, Penalties, Statutory Requirements, Social Obligations/Responsibilities, Labor Welfare, Reports, Records, Files, Common Breaches by – Principal, Contractor, Damage Assessment, Claims for Damages, Quantum Meruit, Force Majeure or Frustration

MODULE IV DISPUTE RESOLUTION 9

General, Methods for dispute resolution − Negotiations, Mediation, Conciliation, Dispute Resolution Boards, Arbitration, Litigation/Adjudication by courts. Conciliation − Appointment of Conciliator, Role of Conciliator, Special Features of Conciliation Dispute Resolution Boards (DRB) − Constitution Of DRB, Functioning of DRB, Procedure for Hearings, Status of Award. Arbitration – Arbitration Agreement, Terms of Reference, Arbitrators Powers, Types of Awards, Interventions by Courts, Setting Aside of Award, Revocation of Arbitrator − Misconduct of Arbitrator.

MODULE V INTERNATIONAL CONTRACTS 9

International Competitive Bidding, Domestic Preference, FIDIC Documents, Conditions, Currency of Bid and Payment, Escalation in Foreign Currency, Financing of projects, Applicable Law and Settlement of Disputes, International Arbitration.

Total Hours –45

REFERENCES:

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

OUTCOMES:

On completion of the course, students will be able to

- define the various elements, types and laws related to contract.
- list the various processes involved in tendering.
- Analyse the performance of contract
- elaborate the process involved in construction arbitration.
- Draft an international contract agreement

CED 6103 ADVANCED CONCRETE TECHNOLOGY L T P C
3 0 2 4

OBJECTIVES:

The course will impart knowledge on

- transition zone in concrete, mix design of concrete, rheological behaviour of fresh concrete and hardened properties of concrete.
- durability properties of concrete, Non-destructive testing for concrete and different types of special concretes.

MODULE I STRUCTURE OF CONCRETE, MIX DESIGN & RHEOLOGY OF CONCRETE 9

Introduction to concrete – Mineral and chemical admixtures – Structure of hydrated cement paste – Transition zone in concrete - Design of concrete mix proportions by ACI and IS 10262:2009 method - IS Method, ACI Method, DOE Method– Statistical quality control – Sampling and acceptance criteria. High Performance – Entropy and Shack lock's Empirical graphs –particle packing theory – Rheological behavior of fresh concrete

MODULE II HARDENED CONCRETE 9

Properties of hardened concrete and their significance- Strength-Porosity relationship – Failure modes in concrete – Behavior of concrete under various stress states – Elastic behavior in concrete - Creep, shrinkage and thermal properties of concrete.

MODULE III DURABILITY OF CONCRETE 9

Strength and Durability Relationship – Volume changes on concrete – Permeability – Interaction between Permeability, Volume Change and Cracking – Factors contributing to cracks in concrete- Freeze and thaw - sulphate attack, alkali aggregate reaction, corrosion of steel rebar – acid attack - concrete in sea water – Tests on durability properties of concrete - water absorption, permeability, sorptivity, resistance to chemical attack, freeze and thaw resistance, accelerated corrosion test, RCPT test, half-cell potential test and macro cell corrosion test.

MODULE IV NON-DESTRUCTIVE TESTING FOR CONCRETE 9

Non-Destructive testing: Rebound hammer – Windsor probe – Ultrasonic pulse velocity – Acoustic emission – Pulse-echo method – Initial surface absorption – Radar technique – Infrared Thermography – Quantab test – Portable crack measuring

microscope – Cover meter –Resistivity of concrete – Semi-destructive testing.

MODULE V ADVANCED CEMENTITIOUS COMPOSITES 9

Fiber reinforced Cementitious Composites - High strength Cementitious Composites – – Polymers in concrete - Self Compacting Concrete –– Shrinkage compensating concrete – Engineered Cementitious Composite - Tube Reinforced Concrete - High Volume fly ash concrete - Structural Light Weight Concrete – Heavyweight Concrete – Sprayed Concrete.

Total Hours : 45

List of Experiments

- Mix design of normal strength grade and high strength grade concrete
- Correlation between cube strength, cylinder strength, splitting tensile strength and modulus of rupture
- Study of stress - strain curve of plain concrete, self compacting concrete and high strength concrete and determination of Young's modulus.
- Fresh properties of self-compacting concrete
- Durability Tests on Concrete – RCPT, sorpitivity test, Acid resistance test, Sea water resistance, permeability test.
- Test on hardened concrete using Non - Destructive Testing Techniques
  i. Rebound Hammer method
  ii. Ultrasonic method

L-45;P-30;Total Hours - 75

REFERENCES:

1. Krishnaraju, N., Design of Concrete Mixes, CBS Publishers, New Delhi, 2007.
2. Malhotra, V.M. and Carino, N.J., "Handbook on Non-destructive Testing of Concrete", CRC Press, 2003.
3. Mehta P.K., and Paulo J.M. Monteiro, Concrete: Microstructure, Properties, and Materials, McGraw-Hill Professional, USA, 2005.
4. Nayak, N.V, and Jain, A.K, Handbook on Advanced Concrete Technology, Narosa Publishing House Pvt. Ltd., New Delhi, 2012.
5. Neville, A.M., and Adam M. Neville, Properties of Concrete, 5th Edition, Pearson, 2011.
6. Zongjin Li, Advanced Concrete Technology, John Wiley & Sons, 2011.

OUTCOMES:

On completion of the course, students will be able to

- Describe the rheological behaviour of fresh concrete and perform the mix design of concrete as per specified standards.
- Elucidate the properties of hardened concrete and study the behaviour of concrete under various stress
- Describe and perform the durability characteristics of different types of concrete.
- Evaluate the concrete structure by using various non-destructive testing methods.
- Suggest suitable type of concrete based on the application and durability requirements.

CED 6125	CONSTRUCTION MANAGEMENT LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

This course will impart knowledge on

- The techniques of estimation using software
- scheduling software like MS Project & Primavera

MODULE I ESTIMATION 9

Quantity takeoff by using MS EXCEL / COSTX - Estimation of Quantities stage wise – Carryout the rate analysis and costing for different stages of work - Preparation and delivery of the bid or proposal of an engineering construction project

MODULE II MS PROJECT 6

Preparation of Planning and Scheduling by using MS PROJECT - scheduling for a small construction project - Allocation of resource- Tracking of a Project-Cost analysis- Reports preparation

MODULE III PRIMAVERA 15

Preparation of Planning and Scheduling by using PRIMAVERA - scheduling for a small construction project - Allocation of resource - Tracking of a Project – Cost Analysis - Reports preparation.

Total Hours –30

REFERENCES:

1. Feigenbaum .L, Construction Scheduling with Primavera Project Planner, Prentice Hall Inc., 2009
2. Paulson. B.R., Computer Applications in Construction, McGraw Hill, 2005.

OUTCOMES:

On completion of this course, students will be able to

- estimate construction projects using Excel/CostX.
- schedule construction projects using MS project.
- schedule constructions projects using Primavera.

SEMESTER II

GED 6201	RESEARCH METHODOLOGY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The course will impart knowledge on

- research to the scholars
- research conceptions for designing the research
- statistical techniques for hypothesis construction
- methods of data analysis and interpretation
- effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 12

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 12

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 12

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 12

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 defense, ethics in research, Patenting, Intellectual Property Rights.

Total Hours –60

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
3. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
4. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.

OUTCOMES:

On completion of this course, students will be able to

- Identify the research problem.
- Become capable of analyzing the data using mathematical techniques.
- Learn to apply the statistical concepts in research.
- Demonstrate the different research methods applicable to a specific problem.
- Prepare the papers for the Journals

CED 6221	CONSTRUCTION ECONOMICS, FINANCE & RISK MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- 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
- financial management
- Risk management

MODULE I CONSTRUCTION ECONOMICS 9

Introduction – Time value of money - quantifying alternatives for decision making - Cash flow diagrams - Equivalence- various interest factors - Arithmetic gradient - Geometric gradient – Present, future and annual worth method of comparing alternatives

MODULE II OTHER COMPARING ALTERNATIVES METHODS 9

Rate of return - incremental rate of return - break-even comparisons - capitalized cost analysis - benefit-cost analysis – tutorial problems

MODULE III EQUIPMENT ECONOMICS 9

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

MODULE IV FINANCIAL MANAGEMENT & ACCOUNTING 9

Financial Management – Cost Reporting vs Cost Control – General Ledger – Job cost Ledger – Equipment Ledger - Method of accounting – Balance Sheet – Income Statement – Over billing – Under Billings – Financial Ratios

MODULE V RISK MANAGEMENT 9

Definitions of risk - elements of risk management - causes of risk –Identifying risk, preparing for risk identification, risk categories, referring to historical information – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk

Total Hours –45

TEXT BOOKS:

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.

REFERENCES:

1. Harris, F. , McCaffer, R. and Edum-Fotwe, F., “Modern Construction Management”, 6th ed., Blackwell Publishing, 2006.
2. Peterson, S. J., “Construction Accounting and Financial Management”, Pearson Education, Upper Saddle River, New Jersey, 2005
3. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
4. Sullivan, W. G., Bontadelli, J. A. and Wicks, E. M., “Engineering Economy”, 11th ed., Prentice Hall, Upper Saddle River, New Jersey, 2001.

OUTCOMES:

On completion of this 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.
- provide an overview of the financial and accounting management including financial statements
- interpret and apply various risk analysis methods to manage/ mitigate risk.

CED 6224	CONSTRUCTION EQUIPMENT MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

The course will impart knowledge on

- various equipment's 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 equipment's and methods.

MODULE II OTHER CONSTRUCTION EQUIPMENTS **6**

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 **6**

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 **8**

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. Deodhar, S.V., Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001.
2. Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., Construction Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore, 2010.

3. Saxena SC, Construction Equipment and Planning, Standard Publishes-Distributors-Delhi, 2009.
4. Sharma S.C., Construction Equipment and its Management, Khanna Publishers New Delhi, 2002.

OUTCOMES:

On completion of this 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 and describe its safety measures

CED 6225	BUILDING INFORMATION MODELING	L	T	P	C
		0	0	2	1

OBJECTIVES:

The course will impart knowledge on

- tools of Building Information Modeling.
- architectural modeling of structure
- structural analysis and design of architecturally modeled structure
- Execution of the same structure at site.

MODULE I INTRODUCTION TO BIM TOOL 5

Introduction to Building Information Modeling (BIM), Discussions of the Roles and Impacts of BIM in the Design, Construction Engineering and Management, Infrastructure Engineering, and Facility Management.

MODULE II DESIGN A RESIDENTIAL BUILDING 5

To design a residential building and its components with provided knowledge about BIM 3D, 4D, 5D, 6D & 7D. Annotate the model with 2D drafting elements and access building information from the building model's database - Creating and editing architectural & structural floor, Creating new material, Developing ceiling plan, adding ceiling, hosted components, interior space planning, developing interior 3D image using camera & rendering.

MODULE III INTRODUCTION TO MEP 10

New MEP Project, Linking an Architect Revit file, Views, Controlling Visibility, Elevation, Section, Creating Callout, Ceiling Plans, View Template, Section Box, Scope box - Space and Zone , Room and Room Tag, Creating Spaces, Modifying Spaces, Area and Volume Calculation, Creating Zone, Systems Browser and Colour Scheme

MODULE IV INTEGRATING WITH STAAD PRO 5

Structural Modeling, Design and Analysis, importing the model into STAAD Pro and analyzing. Types of loads in building analysis. Self-Weight, Dead Load from beams, columns, walls. Frame analysis- Beam end forces, Shear force and bending moment diagram. Specifications for release and offset. Building frame analysis.

MODULE V INTEGRATING WITH PRIMAVERA & NAVIS WORKS 5

Introduction to Software like Primavera-P6/MS Project/Sure trak-For schedule development and tracking of it; Prolog-Data Management- RFI's (Request for Information), Submittals-Product Data, Punch list etc. , Financial Management- For use of tracking and developing the cost reports and issuing the change orders,

Navis works-In this software 3D Auto CAD / Revit model can be imported with a project schedule to review the progress of the Project – Clash Detection of services

Total Hours –30

REFERENCES:

1 Eastman, C., Teicholz, P., Sacks, R., & Liston, C. (2011). BIM handbook: A guide to building information

2 Hardin, B., & McCool, D. (2015). BIM and construction management: proven tools, methods, and workflows.John Wiley & Sons.

3 Issa, R. R., & Olbina, S. (Eds.). (2015, May). Building Information Modeling: Applications and Practices, American Society of Civil Engineers.

4 Krygiel, E., & Nies, B. (2008). Green BIM: successful sustainable design with building information modeling, John Wiley & Sons.

5 Modeling for owners, managers, designers, engineers and contractors. John Wiley & Sons.

OUTCOMES:

On completion of this course, students will be able to

- understand concepts of Building Information Modelling.
- design a building structure using software
- create new MEP project and link it with BIM
- analyze the structure and link it with BIM
- develop schedule using primavera and do clash detection using Navis Works.

CED 6223	MINI PROJECT	L	T	P	C
		0	0	2	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 & cost, prepare a network diagram, track, update and crash the project.
- The students are expected to implement the same plan using Project Management software’s.
- The faculty act as facilitator in helping students to acquire the technical knowledge and basic proficiency needed to perform the master plan.

SEMESTER III

		L	T	P	C
CED 7122	**INTERNSHIP**	**0**	**0**	**2**	**1**

GENERAL GUIDELINES:

- It carries one credit for two weeks of internship.
- Internship shall be of not less than two weeks duration and shall be organized by the Dean of the Department.
- Students should choose preferably, government agencies/ IIT's/ NIT's /major industries in their specialization to do their internship
- At the end of industrial internship, the student shall submit a certificate and feedback from the organization. Students should also submit 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.

CED 7121	PROJECT WORK (PHASE I)	L	T	P	C
		0	0	0	6

OBJECTIVES:

To provide opportunity for the students to exhibit their capacity in executing a project work and provide meaningful solution to a research or real world problem related to Construction Engineering and Project Management.

GENERAL GUIDELINES:

At post graduate level project work shall be carried out by the student individually

- Student shall select a project topic of his/her interest relevant to Construction Engineering and Project Management and approach any faculty member of the department with expertise in that field and get his willingness to supervise the project.
- Students are permitted to carry out their project in an Industry / Research organization, with the approval 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. Proper permission and approvals should be obtained from the industry and documented.
- The information related to proposed topic and the faculty member willing to act as guide shall be informed to the project co-ordinator within 15 days from the commencement of the semester.
- Supervisor identified by the student shall be approved by the Professor in-charge or Head of the Department considering the guidelines followed in the department to allot supervisor for student projects
- The project co-ordinator in consultation with Professor in-charge or Head of the Department shall give initial approval to start the project work.
- A project review team comprising of minimum two senior faculty members of the department preferably doctorates shall be appointed by the Head of the Department.
- Project review schedules, weightage for each review and rubrics for evaluation will be prepared by the project co-ordinator in line with the academic calendar and informed to the students in advance.

- A minimum of three reviews shall be conducted to evaluate the progress of the students. All the members of the review committee shall evaluate the students individually and the mean value shall be taken for grading.

- Student should meet the supervisor periodically and attend the review committee meetings for evaluating the progress. Proper documents shall be maintained by the supervisor to ensure the attendance and progress of the students.
- In the project phase I, students are expected to identify a suitable topic, draw the need for present study and scope of the investigation, review at least 25 journal papers in the related field, formulate the experimental / analytical methodology and conduct preliminary studies.
- At the end of project work phase I, students should submit a report based on the preliminary studies and the future work to be carried out.

OUTCOMES:

Students will be able to

- Apply their practical knowledge and skill in Civil Engineering with specialization in to solve real time problems
- Prepare an appropriate documentation

CED 7121	PROJECT WORK (PHASE II)	L	T	P	C
		0	0	0	18

OBJECTIVES:

To provide opportunity for the students to exhibit their capacity in executing a project work and provide meaningful solution to a research or real world problem related to Construction Engineering and Project Management.

GENERAL GUIDELINES:

- Project work phase II is a continuation of phase I following the same guidelines.
- The project co-ordinator shall arrange to conduct three reviews to ascertain the progress of the work and award the marks based on the performance.
- Detailed experimental investigation / in-depth analytical study / Preparation of specimens / testing have to be performed in-line with the scope of investigation.
- The students are expected to analyse the obtained results and discuss the same in an elaborate manner by preparing necessary charts / tables / curves to get an inference.
- The important conclusions need to be drawn and scope for further research also to be highlighted.
- The outcome of project work shall be published in journals / conference of National or International importance.
- At the end, students should submit a report covering the various aspects of Project work.
- The typical components of the project report are Introduction, Need for present study, Scope of the Investigation, Literature review, Methodology / Experimental investigation / development of software packages, Results & discussion of experimental and analytical work, Conclusions, References etc.
- The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last Instructional day of the semester.
- The project co-ordinator in consultation with head of the department and controller of examination shall arrange for an external expert member to

conduct the final viva-voce examination to ascertain the overall performance of the students in Project work.

OUTCOMES:

Students will be able to

- Apply their practical knowledge and skill in Civil Engineering with specialization in to solve real time problems.
- Prepare an appropriate documentation.

VALUE ADDED COURSE	L	T	P	C
	0	0	0	0

OBJECTIVES:

- To expose the latest technology / tools used in the industry and enable the students acquire knowledge and skill set in the same.

GENERAL GUIDELINES:

- Students should undergo any relevant certification course offered by the institution or other institutions / universities / IIT / IISc etc. for a minimum of 40 hours.
- Selection and completion of value added course by the students shall be endorsed by Head of the Department.

OUTCOMES:

- Students should be exposed and gained knowledge in any one latest technology used in the industry

MOOC COURSE

L	T	P	C
0	0	0	0

OBJECTIVES:

- To learn the basics principles and concepts of the topic in which a project work is undertaken by the student.

GENERAL GUIDELINES:

- Students shall identify a MOOC course related to his/her project topic in consultation with the project supervisor.
- Student shall register for a MOOC course with minimum two credit offered by any recognized organization during the project phase I.
- Selection and completion of MOOC course by the students shall be endorsed by Head of the Department.

OUTCOMES:

Students will be able to

- Familiarize the basic principles and concepts related to the topic of his/her project work.
- Utilize the knowledge gained in the field of study to perform literature review with ease.
- Formulate the experimental / analytical methodology required for the project work

PROFESSIONAL ELECTIVES
II SEMESTER
INFRASTRUCTURE MANAGEMENT

		L	T	P	C
CEDY 221	**INFRASTRUCTURE PLANNING AND MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

The course will 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
- planning of infrastructure
- problems in infrastructure development and management

MODULE I BASIC CONCEPTS RELATED TO INFRASTRUCTURE 10

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 12

A Historical overview of infrastructure privatization. - Benefits - problems with Infrastructure privatization- . 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 8

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 8

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 7

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 government's 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. Jeffrey Delmon Public-Private Partnership Projects in Infrastructure: An Essential Guide for Policy Makers,2017.
3. Weber, B., & Alfen, H.W., Infrastructure as an asset class – Investment strategies, project finance and PPP, West Sussex: John Wiley & Sons, 2010.
4. Yescombe .E .R Public-Private Partnerships: Principles of Policy and Finance Hardcover'2007.

OUTCOMES:

On completion of this course, 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.

CEDY 222	ICT BASED CITY AND INFRASTRUCTURE PLANNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- exposure to changing scenario in the spatial order of cities and regions as well as the emergence of virtual societies in the world.
- the use and power of emerging new technologies and social networks among communities across the city, country and globe demand for paradigm shift in the spatial planning outlook and governance edge.

MODULE I PLANNING VS TECHNOLOGY 10

Tradition to modernity – Spatial planning and technology interface - Socio-economic planning and technology interface – Planning cities and local technologies - Technological innovations and responsive city planning - Planning responsive technology Vs technology responsive planning.

MODULE II CITIES-TECHNOLOGY-INFRASTRUCTURE 12

Transportation and technology, water, sanitation and technology, energy efficient technology for home, street, neighborhoods and city - Telecommunication, health and education – Security and safety for buildings and people in cities.

MODULE III TECHNO CITIES 8

Digital cities, virtual cities, technology parks - Smart planning and infill development – Planning, design and communication system - Socio-economic and environmental Impact of techno cities.

MODULE IV GOVERNANCE 8

Role of law and technology, administration and organization, industry and corporate, Communities and people in building smart cities and smart communities.

MODULE V CASE STUDIES 7

Best practices in India and around the world regarding the project management in smart cities

Total Hours –45

REFERENCES:

1. Brkovic, M. B., ‘Planning in the Information Age: Opportunities and Challenges of e- Planning, CORP, 2004
2. City Government of Naga, ‘The Naga City Citizen Chartes- A Guide Book of City Government Services. 2004
3. Elizabeth, S. Frans, V. ‘IDENSITY: Planning Paradigms for the Information Communication.
4. Information and Communication Technology for Sustainable Development: Proceedings of ICT4SD 2018 (Advances in Intelligent Systems and Computing)
5. Patil.S.S, “ICT Infrastructure in Indian education”, Prateeksha Publications 2012

OUTCOMES:

On completion of this course, students will be able to

- cope up with the application technology
- understand the impact on the infrastructure planning
- design the infrastructure based on ICT
- understand the role of technology
- execute the best practice around the world

CEDY 223	REMOTE SENSING AND GIS IN INFRASTRUCTURE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the principles of remote sensing and the data acquisition and analysis of satellite data.
- data models and data structure used in GIS.
- various raster and vector analysis capabilities of GIS for civil engineering.

MODULE I REMOTE SENSING 9

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 9

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 9

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 9

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 traveler information system and automatic vehicle location system.

MODULE V APPLICATIONS IN WATER AND ENVIRONMENT MANAGEMENT 9

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

OUTCOMES:

On completion of this course, students will be able to

- identify the energy sources and its target interactions, to be interpreted in a satellite image.
- 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.

CEDY 224	RURAL RESOURCES AND DEVELOPMENT PLANNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the village administrative system
- the rural development theories
- the various types of challenges in rural areas
- rural policy and planning
- ICT based rural development.

MODULE I VILLAGE SYSTEM 8

Village as an organic entity – physical, social, economic - Administrative structure of village - Administrative framework of rural areas – village administration – district block – panchayats- Rural land use and morphology – theoretical perspectives - Rural resources – resource mobilization - social and economic implications.

MODULE II RURAL DEVELOPMENT 10

Rural development and planning – smart theories – smart indicators of development - smart Infrastructure development and associated issues - Rural community development strategies link with rural planning - Rural entrepreneurship

MODULE III CHALLENGES OF RURAL AREAS 10

Rural Poverty – factors and processes – social and economic dimensions Rural urban linkages – dichotomy or symbiosis- Rural urban divide in terms of infrastructure facilities- Challenges faced by rural areas –economic, social, environmental, and fiscal.

MODULE IV RURAL POLICY AND PLANNING 8

Rural development and planning – experiences of countries from Global South - Various international, national and regional policies - Strategies adopted and rural development programmes with special reference to India - Critical appraisal of rural development programmes.

MODULE V ICT TECHNOLOGY IN RURAL DEVELOPMENT 9

Technology in Rural Development – use of information technology in rural development, rural Information system, weather forecasting, disaster minimization,

market information, etc. E- Panchayats, energy efficient technologies and alternative technologies.

Total Hours –45

REFERENCES:

1. Barry Dalal-Clayton, David Dent and Olivier Dubois (January 2000) :Rural Planning in the Developing World with a Special Focus on Natural Resources: Lessons Learned and Potential Contributions to Sustainable Livelihoods: An Overview.
2. Carew-Reid J., Prescott-Allen R., Bass S. and Dalal-Clayton D.B. (1994): Strategies for National Sustainable Development: A Handbook for their Planning and Implementation. International Institute for Environment and Development (IIED) and World Conservation Union (IUCN), in association with Earth scan Publications Ltd, London
3. Dalal-Clayton D.B. (1996): Getting to Grips with Green Plans: Recent Experience in Industrial Countries. Earth scan Publications Ltd., London.
4. Dalal-Clayton D.B. and Sadler B. (1995): Strategic Environmental Assessment: A Briefing Paper. Environmental Planning Group, IIED.
5. Roe D., Dalal-Clayton D.B. and Hughes R. (1995): A Directory of Impact Assessment Guidelines. IIED, London

OUTCOMES:

On completion of this course, students will be able to

- Identify rural land use and morphology village system
- understand the rural development and issues
- compile the challenges in rural development
- execute rural planning based on ICT
- apply strategies for rural planning

CEDY 225 URBAN AND REGIONAL PLANNING L T P C
2 0 0 2

OBJECTIVES:

The course will impart knowledge on

- Urbanization and its trend.
- different types of plan and its implementation
- the regional development
- the management for sustainable urban growth.

MODULE I BASIC CONCEPTS POLICIES AND PROGRAMMES 8

Definitions and Concept- Urbanization, Towns, Cities, Metropolis, Megalopolis, Satellite and New towns, CBD, Peri urban areas, Suburban areas, Census Definition, Classification of urban settlements, TOD, National policies, National Urban Transport Policy 2006, National Policy for Urban street vendors 2009- Programme objectives and salient features of Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Urban infrastructure development scheme for small and medium towns (UIDSSMT), Rajiv Awas Yojana (RAY).

MODULE II PLANNING PROCESS 8

Steps in Planning Process- Plans; levels; objectives, content, and data requirement- regional plan, master plan, detail development plan, city development plan, development control regulation, Zoning Regulation, Layout and Building

MODULE III PROJECT FORMULATION AND EVALUATION 7

Constraints for plan implementation – Industrial, Financial and Legal Constraints, Institutional Arrangements for Urban Development – Financing of Urban Developments - Legislation related to Urban Development. Urban infrastructure projects planning, appraisal, formulation, feasibility and preparation of detailed project report, site planning, layout, road network, and service ducts under the road, Environmental impact assessment, and Traffic assessment.

MODULE IV URBAN GOVERNANCE AND MANAGEMENT 7

Planning laws; Town and Country planning act: Urban Development authorities Act, Constitutional (74th Amendment) Act 1992- Local bodies, Functions, powers and Interfaces

Total Hours –30

REFERENCES:

1. CMDA, Second Master Plan for Chennai, Chennai 2008
2. Edwin S.Mills and Charles M.Becker, "Studies In Urban Development", A World Bank Publication, 2006
3. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
4. Singh V.B, "Revitalised Urban Administration" in India, Kalpaz publication, Delhi 2001
5. Thooyavan. K.R, "Human Settlements – A Planning Guide to Beginners. M.A Publications, Chennai 2005.

OUTCOMES:

On completion of this course, students will be able to

- identify various policies and programmes
- understand the various steps in planning process
- design the components of sustainable developments
- illustrate the project formulation and evaluation & gain knowledge on the town and country planning act

CEDY 226	SUSTAINABLE DEVELOPMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course will impart knowledge on

- the concept of sustainability and sustainable development.
- sustainable communities and the economic and social dimensions.

MODULE I INTRODUCTION TO SUSTAINABILITY 5

Concept of Sustainability – Carrying capacity, sustainable development – Bruntland report – Ethics and Visions of sustainability - Circles of Sustainability - Sustainable economy and Use - Various case studies of eco city or communities.

MODULE II SUSTAINABLE URBAN DESIGN AND DEVELOPMENT 10

Overview of urban ecology- Contemporary issues of urban ecology in Asian context and its articulation towards urban design - Urban sustainability focuses on forms and flows of urban - industrial and natural systems - discussion of urban and environmental design - professional practices of ecologically sound urban and environmental design.

Total Hours –15

REFERENCES:

1. Dominique Gauzin – Muller “Sustainable Architecture and Urbanism: Concepts, Technologies and examples”, Birkhauser, 2002
2. Ken Yeang, “Ecodesign : A manual for Ecological Design”, Wiley Academy, 2006.
3. Richard Hyder, “Environmental brief: Pathways for green design”, Taylor and Francis, 2007..

OUTCOMES:

On completion of this course, students will be able to

- describe the concepts of ecosystem, ecological foot print, sustainability and sustainable development.
- familiarize with the various approaches to achieve sustainable buildings and Communities.

ENERGY MANAGEMENT

CEDY 230	CONSTRUCTION DEMOLITION & WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on :

- Waste Generation in construction
- Treatment on demolition waste
- Processing of demolition waste
- Tools used for waste estimation
- Environment degradation due to waste

MODULE I INTRODUCTION 9

Environmental Impact of Building Materials Embodied energy of materials; impact on the local environment; toxicity of the material; Nature and Source Direct and indirect waste; site types and origins; composition; quantity; current recycling/reuse potential of building materials - C & D waste – definition, applicability and waste generating activities – Quantity of Waste generated- Quantifying C & D Waste – Composition – C & D Waste Utilization – Initiatives to promote recycling of C & D waste in India – Codal Provisions

MODULE II WASTE MANAGEMENT 9

Construction and Demolition Waste Management Plans International good practice; planning requirements; demolition plans; site implementation; supplier agreements; sub−contractor management; role of waste management contractor; training; auditing; current markets; current disposal options; health and safety; reporting to local authorities. Hierarchy in waste management - Treatment of Construction and Demolition Waste, waste permits; waste licenses; waste transfer facilities; landfills; treatment technologies; hazardous waste facilities;

MODULE III WASTE PROCESSING 8

Designing for Waste Prevention and Minimisation Waste prevention and minimization; client, contractor and designer attitudes; proper maintenance of existing buildings; reuse of existing building structure; design flexibility; design for reuse and recycling; Recycling – Process involved – Centralised/ Decentralised –Barriers - dimensional co−ordination and standardization; modular design; material selection and control.

MODULE IV WASTE FORECASTING TOOL 10

Waste Forecasting Tools Application of WRAP's designing out waste tool for buildings and civil engineering; WRAP net waste tool; BRE SMART Waste; WRAP Site Waste Management Plan Tracker

MODULE V ENVIRONMENTAL DEGRADATION 9

Environmental degradation due to indiscriminate disposal of C & D wastes in cities - Effective C & D Waste Management – Opportunities for resource conservation & employment generation - Dust Generation – Dust Mitigation - Future developments Potential future markets; ‘smart' materials; use of eco−materials – Case Studies

Total Hours –45

REFERENCES:

1. Greg Winkler, “Recycling Construction and Demolition waste: A LEED-Base Toolkit, Mc Grew Hill Professional,2010
2. Springer, “Recycling and Resource Recovery Engineering”, Springer-Verlag Berlin Heidelberg (1996).
3. Tam.V.M, Chi Ming Tam, “Reuse of Construction and Demolition Waste in Housing Development”, Nova Science Publishers, 2008.

OUTCOMES:

On completion of this course, students will be able to

- Quantify the construction and demolition waste
- Select the type of treatment to be executed
- Minimize the waste using different methods
- Apply Tools for waste management
- Recognize the degradation of environment.

CEDY 231	ENVIRONMENT & ENERGY FOR SUSTAINABLE CONSTRUCTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- environmental compliances and management systems for buildings and infrastructure projects.
- policies, standards, procedures, and various formats relating to environmental compliance
- financing of energy efficient projects.
- skills and sensitivity towards sustainability of built-environment.

MODULE I INTRODUCTION 9

Environment and its impact: Concept of Environment & Environmental Impact Factors & area of consideration for Mega Projects such as Airports Highways, Power Projects, Water Related Projects. 3E‘s Environmental Economics, Ethics & Ecology of sustainable development Measurement of Environmental &Socio Economic Impact & Other concepts: Natural /Physical Environmental Impacts, Social Impacts, Economic Impacts Concept of Significance Effect, Commitments of resources.

MODULE II SOCIO ECONOMIC IMPACTS 9

Socio Economic Impacts: Physical, Social, Aesthetic and Economic Environment, Type of Socio economic Impacts, Outline of basic steps in performing the socio economic assessment, Fiscal Impacts Analysis

MODULE III ENVIRONMENT AND POLLUTION CONTROL LAWS 9

Rules and regulations & Laws governing Energy ,Conservation in India & developed Nations – Energy Conservation Act 2001,Revisions and present state of implementation standardization & Labeling ,Electricity Act 2003 ,Revisions and present status of implementation

United nations Framework Convention on Climate change(UNFCC),Protocol, Conference of Parties(COP), Clean Development Mechanism(CDM),Prototype Carbon Funds(PCF), Carbon credits and its trading, Benefits to developing countries

MODULE IV FINANCING OF ENERGY EFFICIENT PROJECTS 9

Energy efficient Projects, Evaluation of energy efficient projects, Various ways of financing Energy efficient projects, Role of Financial Institutions and corporate banks,

Deferred Payment Financing , Types of energy Performance Contracts, Energy Services Companies (ESCOs), and their role, Emphasis on ESCOs

MODULE V ENERGY MANAGEMENT 9

Energy management of electrical equipment – Improvement of power factor-management of maximum demand-Energy savings in Pumps-Fans Compressed air Systems-energy savings in lighting system-air conditioning system Applications-Facility operation and maintenance- facility modifications – energy recovery dehumidifier- water heat recovery –steam plants and distribution systems improvement of boiler efficiency- frequency of blow down – steam leakage-Steam flash and condense return.

Total Hours –45

REFERENCES:

1. Energy Conservation Act 2001, Electricity Act 2003.
2. Energy Management Handbook By Steve Doty And Wayne C. Turner, 9th Edition,2018
3. Environmental and Pollution Laws in India by Justice T. S. Doabia, I. P. S. Doabia and M. S, S. Doabia, Second Edition 2010.
4. Environmental Engineering, 4 E by Weiner CBS Publishers 2010.
5. Environmental Impact Assessment and Audit by Larry W. Canter Environmental, Tata McGraw Hill,2012
6. Environmental Monitoring and Characterization by Artiola CBS Publishers 2006.
7. Environmental Pollution and Control, 4th Edition, J. Jeffrey Peirce, P Aarne Vesilind and Ruth Weiner, Nov 1997
8. Financing Energy Efficiency: Forging The Link Between Financing And Project Implementation, By Silvia Rezessy And Paolo Bertoldi, Institute Of Energy European Commission, May 2010
9. Public Procurement of Energy Efficiency Services Lessons From International Experience by Jas Singh, Dilip R. Limaye, Brian Henderson, And Xiaoyu Shi
10. Socioeconomic and Environmental Impacts of Biofuels, by Alexandros Gasparatos and per Stromberg, October 2012.

OUTCOMES:

On completion of this course, students will be able to

- analyse the environmental impact of Infrastructure development.
- perform socio economic impact analysis.
- apply environmental and pollution control laws in construction
- identify source of funding for infrastructure projects
- choose equipment to conserve energy in buildings.

CEDY 232	ENERGY EFFICIENT STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart 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 – psychometric 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 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 odor 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. Brown, GZ Sun, Wind and Light: Architectural design strategies, John Wiley,2014.
2. Cook. J, Award –Winning passive Solar Design, Mc-Graw Hill, 1984.
3. Moore F., Environmental Control system, Mc Graw Hill Inc., 1994.

OUTCOMES:

On completion of this course, 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.

CEDY 233	GREEN CONCEPTS IN BUILDING ENVIRONMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- green buildings concept
- indoor environment quality
- economics of green building

MODULE I DEFINING "GREEN" AND "SUSTAINABILITY" 8

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 9

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 9

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 **9**

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

OUTCOMES:

On completion of this course, students will be 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.
- perform economic analysis of a green building.

CEDY 234	ENERGY AUDITING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- explain the importance of energy conservation and energy efficiency
- Role of energy auditors
- Importance of energy policy and MIS systems
- Working of audit Instruments

MODULE I GENERAL ASPECTS 8

General Philosophy and need of Energy Audit and Management. Definition and Objective of Energy Management, General Principles of Energy Management, Energy Management Skills, Energy Management Strategy. Energy Audit: Need, Types, Methodology and Approach. Energy Management Approach, Understanding Energy Costs, Bench marking, Energy performance, Matching energy usage to requirements, Maximizing system efficiency, Optimizing the input energy requirements, Fuel and Energy substitution.

MODULE II PROCEDURES AND TECHNIQUES 10

Data gathering : Level of responsibilities, energy sources, control of energy and uses of energy get Facts, figures and impression about energy /fuel and system operations, Past and Present operating data, Special tests, Questionnaire for data gathering. Analytical Techniques: Incremental cost concept, mass and energy balancing techniques, inventory of Energy inputs and rejections, Heat transfer calculations, Evaluation of Electric load characteristics, process and energy system simulation. Evaluation of saving opportunities: Determining the savings in Rs, Noneconomic factors, Conservation opportunities, estimating cost of implementation. Energy Audit Reporting: The plant energy study report- Importance, contents, effective organization, report writing and presentation.

MODULE III ENERGY POLICY PLANNING AND IMPLEMENTATION 9

Key Elements: Force Field Analysis, Energy Policy-Purpose, Perspective, Contents and Formulation. Format and Ratification, Organizing: Location of Energy Manager, Top Management Support, Managerial functions, Role and responsibilities of Energy Manager, Accountability. Motivating – Motivation of employees, Requirements for

Energy Action Planning. Information Systems: Designing, Barriers, Strategies, Marketing and Communicating Training and Planning

MODULE IV ENERGY BALANCE & MIS 9

First law of efficiency and Second law of efficiency, Facility as an Energy system, Methods for preparing process flow, Materials and Energy Balance diagram, Identification of losses, Improvements. Energy Balance sheet and Management Information System (MIS) Energy Modeling and Optimization.

MODULE V ENERGY AUDIT INSTRUMENTS 9

Instruments for Audit and Monitoring Energy and Energy Savings, Types and Accuracy

Total Hours –45

REFERENCES:

1. Craig B. Smith & Kelly Parmenter, Energy Management Principles: C.B.Smith
2. Efficient Use of Energy : I.G.C.Dryden, Butterworth Scientific, 1982
3. Energy Economics -A.V.Desai, Wieley Eastern, 1990
4. Industrial Energy Conservation : D.A. Reay, Pergammon Press, 1979
5. Murphy W. R, Energy Management:, G.Mckay, Butterworth-Heinemann,1981

OUTCOMES:

On completion of this course, students will be able to

- classify & identify renewable sources of energy
- perform energy audit in buildings
- frame energy policy for organisations
- deploy MIS systems for energy management
- Select equipments for performing energy audit

GENERAL MANAGEMENT

CEDY 240	CONSTRUCTION ACCOUNTING AND ADVANCED EXCEL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The course will impart knowledge on

- principles of accounting
- preparation of financial Statement like Trading Account, P & L Account, Balance Sheet, and Fund flow & Cash flow statements with specific reference to construction industry
- preparation of functional budgets
- marginal costing technique for managerial decision making

MODULE I INTRODUCTION TO ACCOUNTING 8

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

MODULE II FINANCIAL ACCOUNTING 7

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 8

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 COST ACCOUNTING 7

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

LIST OF EXPERIMENTS: 30

1. Finding a Local Minimum Using the Excel Solver.
2. Solving a System of Non-Linear Equations.

3. How to sort and filter the pivot table.
4. Creates 3 range names and uses them to calculate the revenue, costs and profit.
5. Create VBA Do loop sum, sum of powers, Sort array, Simple loop and VBA Recursive factorial.

Total Hours - 60

REFERENCES:

1 JainJain S.P and K.L. Narang, “Cost Accounting Principles and Practice” Kalyani publishers, 2012

2 Maheswari S. N., Suneel K Maheswari and Sharad K Maheswari, “A Text Book of Accounting for management”, Vikas publishing house pvt. Ltd., Noida, 2013

3 Reddy T S and Murthy A, “Financial Accounting” Margham Pucblications, 2012

4 Shashi K Gupta and Sharma R K, “ Management Accounting – Principles and practice”, Kalyani publishers, Ludiana, 2013

OUTCOMES:

On completion of this course, 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.
- apply marginal costing techniques in managerial decisions.

CEDY 241	PERSONNEL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the various aspects of manpower management in construction.
- organizational approach of individual and management.
- various perspectives of managing and developing skills.

MODULE I MANPOWER PLANNING 9

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

MODULE II ORGANISATION 9

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 AND PSYCHOLOGY 9

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 AND REGULATORY REQUIREMENTS 9

Compensation – Safety and health – GPF – EPF – group insurance – housing - pension – laws related to welfare measures - Employee Separations, Downsizing & Outplacement, HRIS, Fundamentals of Industrial Relations and Fundamentals of regulatory requirements.

MODULE V MANAGEMENT AND DEVELOPMENT METHODS 9

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 Dwivedi R.S, Human Relations and Organizational Behavior, Macmillan India Ltd., 2005.
3 Josy.J. Familaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1985.
4 Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.

OUTCOMES:

On completion of this 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 behaviour principals to improve the morale and behavioural aspects of human resources.
- Demonstrate various welfare measures available to human resources.
- Analyse the various development benefits and principles to effectively manage the resources and increase in productivity.

CEDY 242	SAFETY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- Safety aspects involved in construction industry.
- Policies followed and awareness in construction industry
- Development of a safety culture in all our activities
- Safety Management and acknowledgement at all times that safety is paramount.

MODULE I INTRODUCTION 9

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 9

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.

MODULE III SAFETY AWARENESS AND POLICY 9

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 - Study of safety policies, methods, equipment, training provided on any ISO approved construction company, safety in office.

MODULE IV SAFETY PRACTICES AND MONITORING 9

Implement A Reporting System - Provide Training - Conduct Inspections - Hazard Control Ideas - Implementing Hazard Controls - Address Emergencies - Make Improvements - Safety And Health As The Top Priority – Monitoring Safety Practices – Case Study.

MODULE V OWNER'S AND DESIGNER'S OUTLOOK 9

Accident Prevention – Cost of Accidents – Safety and Productivity – Safety Provision in the Factories act – Accident Reporting Investigation and Statistics – Total loss control and damage control – Safety sampling – Safety audit – Critical incidents technique – Safety equipment – Planning and Site preparation – safety system of storing construction materials – excavation – Blasting – Timbering – Scaffolding – Safe use of Ladder – Safety in Welding.

Total Hours - 45

REFERENCES:

1. Construction Safety Management Tim Howarth, Paul Watson, Wiley-Blackwell, 2008.
2. Construction safety manual – SP 70 published by National Safety Commission of India- 2007.
3. Handbook On Construction Safety Practice, SP – 70 , BIS, (2001)
4. Safety Management in Construction Industry – A manual for project managers. NICMAR Mumbai, 1998.

OUTCOMES:

On completion of this course, students 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.
- Provide the necessary training to build and maintain meaningful aerodrome operational safety leadership skills.

CEDY 243	QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- The quality management systems.
- Quality planning, assurance and improvement techniques.
- Statistical control and standards in construction industry.

MODULE I QUALITY MANAGEMENT 9

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 9

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 9

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 9

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 TQM & QUALITY STANDARDS 9

Quality standard codes from its application point of views- Basic concepts of TQM – TQM Framework - Barriers to TQM – Quality statements - Concepts of Six Sigma – Quality Function Development (QFD) – Case studies relating to TQM - 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. Arora.K.C., ISO 9000 to OHAS 18001, S.K. Kataria & Sons; Reprint 2012 edition
3. Er. Basu Roy.S.C, Modern Concept of Total Quality Control and Management for Construction, Nabhi Publication (2013)
4. James, J.o' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 2012.
5. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 2000.

OUTCOMES:

On completion of this course, students will be able to

- Understand the basis of quality management system.
- check the quality in civil construction works.
- Apply techniques to improve the quality in construction.
- identify the variations in quality of civil works.
- use various standard codes in civil construction works.

CEDY 244 SHORING, SCAFFOLDING AND FORMWORK

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will 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 **9**

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 **9**

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 **9**

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 behavior 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 **9**

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 **9**

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.

OUTCOMES:

On completion of this course, 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.

CEDY 245	CMDA BUILDING REGULATIONS & APPROVAL	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course will impart knowledge on

- Various building regulation and act of Chennai metropolitan development authority.
- Application procedure, documents required payment and various regulations.

MODULE I INTRODUCTION 6

Access – accessory use – act and section – alteration - assembly building – authority - balcony - basement or cellar - building and building line - security cabin - canopy/portico/porch – chimney - competent authority – corridor - continuous building - covered area – development – drain - dwelling unit - floor space index(FSI) – farm house – group development – height of the building – layout – local authority or local body – mezzanine floor – multistoried building – ordinary building – parking space – passage - plinth area – plot/site area – plot coverage – road/street width – row housing/row type building – set back – site/plot – special building - stilt floor – street alignment – sub-division – verandah – other terms.

MODULE II PROCESS 9

Written Permission for development-Manner of obtaining permission - Scrutiny fees - Completion Certificate - Development to be in conformity with these regulations - Designation of use in Master Plan or Detailed Development Plan - Requirement for site approval - Proposed width of roads - Transferable Development Rights - Transferable Development Rights - Special Transferable Development Rights - Proximity to quarries and crushers - Structures in setback spaces - Boundaries of land use zones - Primary Residential use zone - Mixed Residential use zone - Commercial use zone - Industrial use zone - Special and Hazardous Industrial use zone - Institutional use zone - Open Space and Recreational use zone -Agricultural use zone - Development prohibited areas - Planning Parameters - Regulation for Special Buildings - Layout and sub-division regulations - Conservation of buildings of historical or architectural Interest - Tree preservation - Identification of boundaries. Application procedure and documents required – online payment – verification of payment.

Total Hours – 15

REFERENCES:

1. Second master plan for Chennai metropolitan area, Volume II - Development Regulations, 2016
2. The madras metropolitan development authority Service regulations, 1980.

OUTCOMES:

On completion of this course, students will be able to

- Illustrate various building regulation and acts of Chennai metropolitan development authority.
- apply for approval of documents in CMDA.

ADVANCED TOPICS

CEDY 250	LEAN CONSTRUCTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

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

MODULE I LEAN HISTORY & PRINCIPLES 9

Origins and Essence of Lean - Eight Major Wastes (Non-value-added work) - Two Pillars of The Toyota Way - 4P Model of the Toyota Way- Five of Principles of Lean Thinking- Toyota Production System (TPS)- WIP – cycle time – little's law –queuing theory

MODULE II VARIATION IN PRODUCTION SYSTEMS 9

Define different types of variation in project delivery - Explain the concept of throughput - Distinguish between 'throughput' and 'works in progress' - Describe the role of variation in production operations - List sources of variation in construction settings - Differentiate and explain variation mitigation techniques

MODULE III PULL IN PRODUCTION 9

Compare batch-and-queue and continuous-flow production systems - Distinguish between 'push' and 'pull' systems - Describe the impact of 'pull' on production systems - Explain how 'pull' strategies can be utilized in construction operations - Describe the concept of Lean Work structuring - Outline the desired outcomes of Lean Work structuring

MODULE IV LEAN SUPPLY CHAIN AND ASSEMBLY 9

Differentiate between traditional procurement practices and lean supply chain applications - Identify waste and value-adding activities within the supply chain and assembly - Evaluate the impact of using lean supply chain on waste elimination, continuous flow and site operations pull - Identify strategies needed at the project and company levels to support the lean supply chain - Expand lean beyond the individual project

MODULE V LEAN DESIGN AND PRE-CONSTRUCTION 9

Distinguish between the varying definitions for design - Define value and commonly used methods to maximize it - Discuss waste and commonly used methods to minimize it - Differentiate between traditional project methods and lean design - Explain the various lean tools used in design and how to deploy them.

Total Hours –45

TEXT BOOKS:

1. Lincoln H. Forbesn and Syed M. Ahmed. Modern Construction: Lean Project Delivery and Integrated Practices, 2010.

REFERENCES:

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

OUTCOMES:

On completion of this course, students will be able to do

- summarize the lean principles.
- explain the variations in production system
- outline the desired outcomes of lean work structuring
- apply lean principles to a small construction project.
- apply various lean tools in design

CEDY 251	MANAGEMENT INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

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

MODULE I INTRODUCTION 9

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

MODULE II SYSTEM DEVELOPMENT 9

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

MODULE III INFORMATION SYSTEMS 9

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 9

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

MODULE V SYSTEM AUDIT 9

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

TEXT BOOKS:

1. Kroenke, D. M., Gemino, A., & Tingling, P. *Experiencing MIS* (4th Canadian Edition). Toronto: Pearson, 2016

REFERENCES:

1. James A. O'Brien, George Marakas Professor, Management Information Systems 10th Edition, McGraw-Hill Education; 2010
2. Joyce J Elam, Case series for Management Information Systems, Simon and Schuster, Custom Publishing, 1996.
3. Kenneth C. Laudon, Management Information Systems: Managing the Digital Firm, Pearson Publishing, 2012

OUTCOMES:

On completion of this course, students will be able to do

- 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.

CEDY 252 AUTOMATION IN CONSTRUCTION

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the application of automation and use of robots in construction.
- Computer applications and material processing.
- HVAC and fire safety measures as per NBC code.
- Energy efficient building, NDT and data acquisition
- Site automation and robotics

MODULE I INTRODUCTION 9

Concept and application of Automation, requirements and design considerations and its effect on functional efficiency of building automation system- Review and analysis of state- of –art in construction automation – current scenario

MODULE II OFF AND ON SITE AUTOMATION IN CONSTRUCTION 9

Off- site automation in construction Information processing (computer applications), materials processing , case study (concrete batch plant) - Existing and prototype equipment for construction – Cranes – Tunnel Boring Machines - case study (concrete placement and finishing), final product design session

MODULE III BUILDING AUTOMATION 9

Introduction to building automation systems – components – Heating, ventilation, and air conditioning (HVAC) – Lighting – Electrical systems water supply and sanitary systems– Fire safety – security -Communication and office automation system -Water pump monitoring & control - Control of Computerized HVAC Systems

MODULE IV NETWORKING 9

Data networking– IBMS system and its components – Centralized control equipment's – substation and field controllers – Gamma building control – energy-efficient building and room automation - Field sensors actuators, controllers, non-destructive evaluation, data acquisition , examples of sensors in existing automated equipment

MODULE V ROBOTICS IN CONSTRUCTION 9

Automation and robotic technologies for customized component, module and building

prefabrication- Elementary technologies and single – Task construction robots - Site automation- robotic on site factories **-** Selecting robot- Activated concrete cutting robot, concrete floor finishing robot- Ceiling panel positioning robot- Exterior wall painting robot-safety and training- case studies

Total Hours – 45

TEXT BOOKS:

1. Javad Majrouhi Sardroud, “Automated Management of Construction Projects” LAP Lambert Academic Publishing, 2011,.
2. Wang Shengwei,“Intelligent Buildings and Building Automation” Taylor & Francis Group, 2010.

REFERENCES:

1. Honglei Xu and Xiangyu Wang, “Optimization and Control Methods in Industrial Engineering and Construction (Intelligent Systems, Control and Automation: Science and Engineering)” Springer, 2014.
2. Majrouhi Sardroud Javad,, “Automation in Construction Management” Scholars' Press, 2014

OUTCOMES:

On completion of this course, students will be able to do

- Illustrate the application of building management system and automation on and off site projects.
- Solve the construction issues through robotic techniques.
- Analyse the application of fire installation and HVAC using the NBC code
- Distinguish different sensors and data acquisition
- measure the application of robotics in civil construction

CEDY 253 VALUE ENGINEERING & VALUATION L T P C
3 0 0 3

OBJECTIVE:

The course will impart knowledge on

- hurdles in value engineering, creative thinking and life cycle costing
- Taxes, insurance and calculation of depreciation.
- Intrinsic values of land and open land valuation
- profit base valuation
- property rights and liabilities valuation of real properties

MODULE I VALUE ENGINEERING 7

Introduction and background of value Engineering. Hurdles in value Engineering. Value Engineering Job Plan. Functional Analysis. Creative thinking, Cost modeling, Life cycle costing, Project work, Worksheets, Guidelines, Checklists. Value Engineering Case studies.

MODULE II PURPOSE OF VALUATION 8

Municipal & Govt. Taxes, insurance, Loss of rent, collection charges, sinking fund, Annual repairs & maintenance. Depreciation. Methods of calculation of depreciation. Different forms of values.

MODULE III METHODS OF VALUATION 8

Open land valuation, Factors affecting intrinsic values of land, Comparative method, Abstractive method, Belting method.

MODULE IV VALUATION OF LAND WITH BUILDINGS 7

Rental method, Land and building method, Valuation on profit basis, Direct comparison of capital value, Residual or Development method. Valuation of agricultural farm lands.

MODULE V PROPERTIES RIGHTS AND MARKET VALUE 8

Self-imposed, Legally created, Dominant and Servient heritage Effect of easements on valuation. Real Estate market and market value, fair market value, open market value, affecting parameters. Valuation of real properties.

Total Hours : 45

REFERENCES:

1. Banerjee D.N," Principles and Practice of Valuation ". Eastern law house, 2015.
2. Rao Gopinath C H, “Valuation Practices of Immovable Properties.” Edition 12, Publisher, C H Gopinath Rao, Chennai, 2002
3. Roshan H. Namavathi, "Professional Practice” Lakhani Book Depot, 2001.

OUTCOMES:

On completion of this course, students will be able to

- understand the complete knowledge background about value engineering
- workout the depreciation, sinking and maintenance cost for a property
- apply various methods of valuation
- understand the importance of property right and its liability
- Distinguish different market value and workout the cost of a real property.

CEDY 254 PRE ENGINEERED STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

The course will impart knowledge on

- the importance of prefabricated and precast structures as applied to concrete, RCC and structural steel.
- importance of standardization, modular construction, tolerances as per national building code of practice.
- various prefabricates and their design philosophy as applied to tension, compression, shear and flexural elements.
- the various construction techniques and equipment's for transportation of precast elements.
- different construction techniques involved in construction management.

MODULE I PREFABRICATED CONSTRUCTION 9

Prefabricated construction, necessity, advantages, disadvantages, Mass produced steel, reinforced concrete and masonry systems Industrialized buildings

MODULE II CODAL SPECIFICATION 9

Modular coordination, basic module, planning and design modules, modular grid systems, National Building Code Specifications, standardization, dimensioning of products, preferred dimensions and sizes, tolerances and deviations, layout and process.

MODULE III PREFABRICATED ELEMENTS 9

Prefabricates classification, foundation, columns, beams, roof and floor panels, wall panels, clay units, box prefabricates, erection and assembly.

MODULE IV DESIGN OF PREFABRICATED ELEMENTS 9

Design of prefabricated elements, Lift points beams, slabs, columns, wall panels, footings, design of joints to transfer axial forces, moments and shear forces

MODULE V CONSTRUCTION TECHNIQUES & EQUIPMENTS 9

Construction techniques, large panel construction, lift slab system, Glover system, Constains's Jack - block system, Constain V-plate system, Bison system, Silber –Kuhi system, control of construction processes - Equipment's

for horizontal and vertical transportation.

Total Hours : 45

REFERENCES:

1. Hubert Bachmann and Alfred Steinle, Precast Concrete Structures, Wiley VCH, 2011
2. Kim S. Elliot , Precast Concrete Structures, CRC Press, 2017
3. Ryan E. Smith, Prefab Architecture: A Guide to Modular Design and Construction, John Wiley and Sons, London, 2010

OUTCOMES:

On completion of this course, students will be able to do

- Identify suitable precast module and system for structural elements based on the requirements of national building code.
- Classify and design different prefabricated systems subjected to various forces.
- Apply different construction techniques for operating various elements such as panels, slabs and plates.
- Use proper equipment’s for horizontal and vertical transportation of pre-cast elements.
- Understand large panel construction and its process.

CEDY 201	ADVANCED FOUNDATION DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVE:

The course is aimed at

- Enabling the learners to be familiar with field and lab test encountered in engineering practice
- To impart knowledge to analyze and design shallow and deep foundation.

MODULE I SOIL EXPLORATION FOR DIFFERENT PROJECTS 09

Methods of subsurface exploration, Field tests, penetration tests, Methods of borings along with various penetration tests - Plate load test, field permeability tests

MODULE II SHALLOW FOUNDATIONS 10

Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Factors affecting bearing capacity Factors influencing selection of depth of foundation, types of shallow foundations, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

MODULE III LATERAL AND UPLIFT LOAD EVALUATION OF PILES 10

Pile Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.

MODULE IV WELL FOUNDATION 08

Types, components, construction methods, design methods (Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.

MODULE V RETAINING WALLS 08

Types -flexible and rigid earth retention systems, counter fort, gravity, diaphragm walls, sheet pile walls, soldier piles and lagging. Support systems for flexible retaining walls (struts, anchoring), construction methods, stability calculations, design of flexible and rigid retaining walls.

Total Hours: 45

REFERENCES:

1. N.P. Kurian, “Design of foundation systems: Principles and Practices”, Narosa Publishing House, 2014
2. Bowles J E “Foundation Analysis & Design” McGraw Hill Education; 5 edition (1 July 2017)
3. T. W. Lambe & R. V. Whitmen, “Soil Mechanics” - Wiley Eastern Ltd.,2000
4. Varghese P.C.,"Design of Reinforced Concrete Foundations”, PHI Learning Private Limited, New Delhi, 2009
5. Murthy, V.N.S., "Advanced Foundation Engineering", CBS Publishers, New Delhi, 2007

OUTCOME:

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

- Decide the suitability of soil strata for different projects
- Design shallow foundations based on the bearing capacity of soil
- Analyze and design the pile foundation, perform lateral and uplift load analysis for pile foundation
- Analyze and design well foundation
- Design retaining wall and checking the stability

PROFESSIONAL ELECTIVES
III SEMESTER

INFRASTRUCTURE MANAGEMENT

		L	T	P	C
CEDY 121	**PROJECT MANAGEMENT IN SMART CITIES**	**3**	**0**	**0**	**3**

OBJECTIVES:

The course will impart knowledge on

- project management tools and techniques applicable for planning monitoring of smart infrastructure and smart cities.
- 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 - 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 CONTROL IN SMART CITIES **10**

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 –45

REFERENCES:

1. Chitkara, K.K, Construction Project Management, 3 rd Edition, McGraw-Hill Publishing Company, New Delhi, 2014
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. Harold Kerzner, 'Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 10th ed. John Wiley & Sons, Inc , 2009.
4. Jimmie W. Hinze, Construction Planning and Scheduling, 4 th Edition, Pearson, New Delhi, 2013

OUTCOMES:

On completion of this course, students will be able to do

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

CEDY 122	URBAN TRANSPORTATION INFRASTRUCTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the scope and nature of urban transportation as a discipline.
- the design components of a transportation infrastructure.
- the various types of intersections
- various techniques of parking facilities
- design elements of terminal facilities.

MODULE I PRINCIPLES OF INTERSECTION DESIGN 8

Basic considerations – simplicity – uniformity – Maneouvre Elements – Separation of conflict points – Design Elements – Design Speed – Intersection Curves – Super elevation for curves at Intersection – Intersection Sight Distance.

MODULE II DESIGN OF AT-GRADE INTERSECTIONS 10

Capacity and LOS, Design of Rotary and Signalized Intersections, Vehicle Actuated Signals, Signal Co-ordination, Area Traffic Control System (ATCS), Pedestrian Planning at Grade Intersections

MODULE III DESIGN OF GRADE SEPARATED INTERSECTIONS 10

Design of Grade Separators – Principles , Design Criteria – Layout Design, GAD Preparation – Pedestrian Foot Over-bridge and Subway Design – Pedestrian Planning for Grade Separated Intersections.

MODULE IV PARKING FACILITIES 8

Parking – Demand – Characteristics – Space Inventory – Accumulation – Duration – Turn over – Index – Design of Multi Storied and Surface Parking facility

MODULE V DESIGN OF TERMINAL FACILITIES 9

Bus Terminus – Design Principles – Design Elements – Design and Case Studies of Inter Modal Transfer Facilities – Design – Case Studies of Bus and Rail Terminals

Total Hours –45

REFERENCES:

1. Kadiyali, L.R., “Traffic Engineering and Transport Planning”, Khanna Technical Publications, New Delhi, 2000.
2. Kanna, S.K. and Justo, C.E.G. "Highway Engineering, Nemchand and Brothers, Roorkee, 2008.
3. New Jersy, "Transportation and Traffic Engineering Hand Book, Institute of Transportation Engineers, Prentice Hall, INC, 2002
4. Robert F Baker, (Eds) "Hand Book of Highway Engineering, Van Nostrand Reinhold Company, New York 2005
5. Subhasg C. Saxena, “A Course in Traffic Planning and Design”, Dhanpat Rai Publications, New Delhi, 2001.

OUTCOMES:

On completion of this course, students will be able to

- consider the basic geometric elements for highway design
- design the at grade intersections
- identify the intersection elements and design of grade separated intersections
- calculate the parking demand and to design a multi storied
- execute the design principles of terminal design.

CEDY 123	URBAN INFRASTRUCTURE AND NETWORK PLANNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the scope and nature of Land use planning
- the design components of various service infrastructure.
- the various types of essential services
- the various network of services
- the status and demand of service planning process.

MODULE I URBAN FORMS, SIZE AND INFRASTRUCTURE 10

Obligatory and discretionary services - Implication of urban form and size on services – Norms and standards - National and Local guidelines - Recommendations of Rakesh Mohan Committee.

MODULE II SITING OF SERVICES AND NETWORK 8

Lay of urban area, sitting of services Vs land use and efficiency - Basics of service network Urban in India – Scope, Content and limitations of Master plan, Structure plan, DDP and Planned unit development - Zoning regulations need, applicability and development regulations

MODULE III ESSENTIAL SERVICES 12

Demand strategy, issues and tasks, operation and management aspects of each service–water supply, sewerage / drainage, solid waste management, roads and street lighting and living environment. Waste Generation – processing of waste – from origin to disposal – financial provisions – budgetary provisions - municipal act – waste management – environmental concerns – community participation – role of other agencies

MODULE IV NETWORK OF SERVICES 6

Priority - Placement network options - Effective system analysis. Transportation - types of transport systems - evolution of various types of transport modes – complementarity between various types of transport modes - hierarchy, capacity and geometric design -elements of roads and intersections - basic principles of transport and infrastructure design – transport cycle, concept of accessibility – characteristic

features of traffic – elements of urban transport planning process.

MODULE V SERVICE PLANNING PROCESS 9

Assessment of status, demand, and community participation - Corporate approach, investment and implementation mechanism - Role of law and technology, administration and organization, industry and corporate communities.

Total Hours –45

REFERENCES:

1. Dhaliwal S.S, 'Urban Infrastructure Development in Small and Medium Towns' Deep and Deep Publications, 2004
2. Schubeler Peter , Participation and partnership in urban infrastructure management, World Bank Publications, 2006
3. Simon Guy, Simon Marvin, Will Medd, Timothy Moss 'Shaping Urban Infrastructures: Intermediaries and the Governance of Socio-Technical Networks' Routledge, 2012
4. Wellmann and Marcus, 'Urban Infrastructure and Finance Management, Wiley Blackwell, UK 2012.

OUTCOMES:

On completion of this course, students will be able to

- provide an understanding of the Urban forms
- describe the scope and limitations of master plan
- identify the various essential services needed
- understand the various network of services
- execute the knowledge on services.

CEDY 124	URBAN SANITATION AND FECAL SLUDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- various aspects of urban sanitation, with a focus on septage/fecal sludge management in India.
- the concepts and principles of urban sanitation and specifically FSM and various elements in the full cycle of sanitation as well as service delivery to urban poor.
- the current status and challenges and critically examine the responses in practice including policy and programmes, regulations and institutional issues, roles of the private sector and civil society and current management practices of wastewater and sanitation
- the emerging paradigms in urban sanitation
- the options for town to improve sanitation along with the challenges faced.

MODULE I INTRODUCTION TO URBAN SANITATION & FECAL SLUDGE MANAGEMENT (FSM) 10

Key aspects and current status of urban sanitation in India - Coverage and performance of Networked and non-networked sanitation systems - Full cycle of sanitation - Sanitation linkages to health, environment and economy - Policy initiatives – NUSP, SBM-U, AMRUT - Current status and challenges of various policy and programmes – Influence of municipal solid waste management, sewage and grey water management, storm water management - Linkages with human excreta management- Components and deficits of full cycle of sanitation – FSM - Understand the Sewage and FS Characteristics and FS quantification - Current/new regulations for treated product disposal/reuse - Challenges and current status of networked systems - Mapping of stakeholders and their roles in the full cycle of sanitation

MODULE II SANITATION URBAN LOCATION & FINANCE FOR URBAN SANITATION 10

Sanitation arrangements in different cities - Sanitation situation assessment - Demonstration to estimate the amount of human waste generated and treated in Indian Cities - Demonstration of tools such as Shit flow diagram to visualise the sanitation status of a city- Legal and institutional framework in India across various states and cities - Current policies and programmes - Institutional issues - Roles of

the private sector, civil society - Evolution and challenges. Access to sanitation from an equity and gender perspective - Inclusive sanitation service delivery in low income communities - Informal settlements – Urban slums - Approaches and initiatives in service delivery - Individual household toilets - Community/ public toilets - How gendered sanitation is, both in terms of access and work and menstrual hygiene management (MHM)

MODULE III FSM - ACCESS, CONTAINMENT, COLLECTION, CONVEYANCE, TREATMENT, DISPOSAL / REUSE 15

Addressing the deficiencies across full cycle of sanitation - Technology options of networked, decentralised and onsite sanitation systems - Design/regulations of OSS such as Septic tanks and twin pits – FS emptying methods and transportation mechanisms - Safe handling of fecal waste by sanitary workers and desludging operators - Technology selection criteria, principles and objectives of treatment - Cotreatment of FS with sewage at Decanting stations and STPs - Options for Exclusive FS treating facilities such as FSTPs – Disposal and reuse of treated products – Challenges in operation and maintenance of receiving and treatment facilities

MODULE IV INNOVATIONS AND COMUNICATIONS IN URBAN SANITATION 5

Emerging paradigms in the Urban sanitation conversations in the country and globally - Innovations in technology and design across the full cycle of sanitation - Narratives of media coverage, academic writing and scientific reporting on Urban Sanitation in India - Mainstream media - Scientific journals - Op-eds - Distinguished communities of practice.

MODULE V MODEL CASE STUDY AND URBAN SANITATION: REFLECTION ON URBAN PRACTICES 5

Model case studies about options for a typical city/town to improve sanitation situation – Develop action plan - Application of various analytical methods and steps taken to arrive at a set of sanitation solutions for a city/town - Challenges faced and means of addressing those challenges

Total Hours – 45

TEXT BOOKS:

1. Central Pollution Control Board (CPCB) (2009), Status of Water Supply, Wastewater Generation and Treatment in Class-I Cities & Class-II Towns of

India. New Delhi, Pg. 1 – 93.
2. GoTN (2014), Operative Guidelines for Septage Management for Local Bodies in Tamil Nadu.
3. Kevin Tayler (2018), Fecal Sludge and Septage Treatment: A guide for low- and middle-income countries, Practical action publishing.
4. Strande, L., Ronteltap, M., and Brdjanovic, D. (2014), Fecal Sludge Management: Systems Approach for Implementation and Operation, IWA Publishing.

REFERENCES:

1. Anand. G et al., 2015, Tracing exclusions in Water Supply and Sanitation, India Exclusion Report, Yoda press. Pg. 67-105.
2. Burt, Z., Nelson, K., and Ray, I. (2016). Towards Gender Equality Through Sanitation Access.
3. Sharada Prasad. C.S and Ray I (2019), When the pits fill up: (in)visible flows of waste in urban India, Journal of Water, Sanitation and hygiene for development, 9(2), 338-347.

OUTCOMES:

On completion of the course, students will be able to

- Explain the impacts of improper sanitation on public health, environment and economy.
- Describe the concepts and principles of urban sanitation and specifically FSM and various elements in the sanitation chain as well as service delivery to urban poor.
- Explain the policy framework and implementation arrangements including institutions and finances, and stakeholders across the sanitation chain.
- List the current management practices of wastewater and sanitation i.e. planning, financing, implementing, operation and maintenance management, service delivery mechanisms, deficiencies and challenges.
- Develop strategies to manage urban sanitation.

CEDY 125 INTEGRATED RURAL DEVELOPMENT L T P C
2 0 0 2

OBJECTIVES:

The course will impart knowledge on

- the scope and nature of Rural planning
- the design components of various rural infrastructure.
- the challenges in rural infrastructure
- the various rural development case study.

MODULE I INTRODUCTION 8

Decentralized planning in India – concept of panchayat raj and hierarchical arrangements - Gandhian and Nehruvian visions – top-down and bottom approaches – trickle down process - Recent amendments and decentralized governance - 73rd and 74th constitutional amendment acts – implication in regional and rural planning – status of local self-government bodies - Participative district planning - role of Planning Commission & Finance Commissions.

MODULE II DISTRICT AS A UNIT OF PLANNING 8

Identification of resources, skills, economic linkages and interconnections – socio-economic and spatial relations of production and consumption - interrelations and interdependencies between communities and micro-regions - Identification of micro-regions on the basis of functions – identifying and strengthening backward and forward linkages – establishing a connection between conventional and newer economic sector – introduction of supportive activities to that of already existing - Institutional and other support for District Planning Committee, Bridging gap through district planning, funds and finances, consolidation of urban and rural plans - Multi-Sector and multi-level integrated approach to planning (vertical and horizontal spatial integration) - Capacity Building for Decentralized Planning - involvement of various stakeholders .

MODULE III PROBLEMS IN INTEGRATED RURAL PLANNING 7

Rapid pace of urbanization and changing profile of rural and peri-urban areas – land transactions – loss of agricultural lands – changing work profile, loss of livelihoods and associated challenges - land conversions and its regulation/facilitation in peri-urban areas - Various Issue in integrated planning – nature of investments in rural

areas – productive and non-productive – market economy and status of agriculture – socio-cultural stratifications and issues of participatory governance – politics of resources and urban dichotomy – placements of rural areas vis-à-vis urban – exploitative regime

MODULE IV INTERNATIONAL RURAL DEVELOPMENT 7

Rural Development experiences of some Asian Countries – China, Malaysia, Sri Lanka, and Bangladesh.

Total Hours –30

REFERENCES:

1. Christopher .J and A. Thomas William, “Rural Development: Concept and Recent Approaches”, 2011
2. Katar Singh,”Rural Development: Principles, Policies and Management” SAGE Texts,2008
3. Nath.V ”Rural Development And Planning In India”, Concept publishing company , 2010
4. Srijeet Banerjee Issues on Rural Finance, Infrastructure and Rural Development, Abhijeet Publications, 2010.
5. Tahir Hussain , Mary Tahir , Riya Tahir , “Fundamentals of Rural development “ I.K. International publishing house2017.

OUTCOMES:

On completion of this course, students will be able to

- examine various policy of rural planning
- relate the interrelations and interdependencies between communities and micro-regions
- execute various rural development programmes
- identify the challenges of integrated rural planning

CEDY 126	GEO-INFORMATICS FOR URBAN/RURAL MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course will impart knowledge on

- spatial data infrastructure development in India
- application of spatial data in urban and regional infrastructure

MODULE I SPATIAL DATA INFRASTRUCTURE DEVELOPMENT IN INDIA **5**

Spatio-temporal data modelling and analysis -Spatial Data Infrastructure: conceptual framework, network development and hierarchy setup use of SDI in urban and regional planning and decision making process - Open Geospatial Consortium –ISO standards (TC211).

MODULE II APPLICATION OF SPATIAL DATA INFRASTRUCTURE IN URBAN AND REGIONAL MANAGEMENT **10**

NRDMS and NSDI – a multi-level spatial data infrastructure – case studies of various state initiatives - NCT Delhi SDI - Karnataka and Kerala Portals – Bhoomi - Gujarat's Tax programme- application to coastal area planning – Tamil Nadu coast.

Total Hours –15

REFERENCES:

1. Burrough, Peter A and McDonnell R.A, Principles of Geographical Information Systems, Oxford University Press, Mumbai, 2008.
2. Campbell. J, Introduction to Remote Sensing, Guilford, New York, 2009
3. Clarke, Keith C, Getting Started with Geographic Information Systems, Prentice-Hall Series in Google. Info. Science, Prentice-Hall, Inc. N.J, 2010
4. Curran, Paul, J, Principles of Remote Sensing, Longman, London,2008

OUTCOMES:

On completion of this course, students will be able to

- Identify the spatial data for development of Infrastructure in India
- Execute the spatial data infrastructure in the urban and regional project.

ENERGY MANAGEMENT

CEDY 130	INTELLIGENT BUILDING MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

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

MODULE I INTRODUCTION 9

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 9

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 9

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 9

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

MODULE V PERFORMANCE OF BUILDINGS 9

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

OUTCOMES:

On completion of this course, students 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

CEDY 131	SUSTAINABLE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the concepts of sustainability in the context of building and conventional engineered building materials, such as Concrete, Bricks, and achieving the same through lower Carbon cements,
- the concepts of Superior brick kilns and Recycled aggregate minimizing consumption of natural resources including water. VOC and indoor air quality.
- concepts of embodied, Operational and Life Cycle Energy, Minimizing Energy consumption by optimal design, use of BIPV.
- awareness of ECBC, LEED, GRIHA etc

MODULE I INTRODUCTION **9**

Introduction - Embodied energy, Operational energy in Building and Life cycle energy. Ecological foot print, Bio-capacity and calculation of planet equivalent Role of Material: Carbon from Cement, alternative cements and cementitious material, Energy for grinding crushing of cement aggregate etc. and reduction.

MODULE II CEMENT **9**

Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete - Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete etc. concrete with alternative material for sustainability' - Reduction in water consumption in concrete, Recycled aggregate

MODULE III BRICKS AND PAINT **9**

Operational energy in building role of materials and thermal conductivity Clay Bricks, Types kilns, Comparative energy performance emission performance and financial performance, Indoor air quality Paints, Adhesive and sealants for use in building, Volatile organic content (VOC) emission issues and indoor air quality for Sustainability and Health hazard

MODULE IV NET ZERO BUILDING **9**

Operational energy reduction and net zero building, Optimization for design of building for energy efficiency and example of optimization through use of Evolutionary genetic

algorithm Radiation budget, Surface water balance, Effects of trees and microclimatic modification through greening,

MODULE V ENERGY RATING 9

Use of Building Integrated Photo Voltaic (BIPV) and other renewable energy in buildings, basic concepts and efficiency -Energy codes ECBC requirement, Concepts of OTTV etc - Green Performance rating, requirements of LEED, GRIHA etc.

Total Hours – 45

REFERENCES:

1. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, Wiley; 4th edition, 2016
2. Green Building Materials: A Guide to Product Selection and Specification Ross Spiegel, Wiley; 3 edition ,2010

OUTCOMES:

On completion of this course, students will be able to

- Compare Alternative material for cement in construction
- Compare Alternative material for paint and clay
- Choose superior kiln for manufacturing tile
- Design net zero building
- Use materials to satisfy energy rating

CEDY 132	ENERGY MODELING	L	T	P	C
		1	0	2	2

OBJECTIVES:

The course will impart knowledge on

- concepts, modeling inputs and analysis methods of building components such a envelope, lighting, occupants, equipment, process loads, HVAC and service hot water systems.
- building performance using energy simulation software.
- to interpret simulation results and troubleshoot errors.
- use of measured building energy data to calibrate simulation model.
- to evaluate EEMs and perform parametric analysis to identify optimal solutions.

MODULE I ENERGY CRISIS, CODES & MILESTONES 15

Energy Crisis, Codes & Milestones • Global trends, “Peak Oil 2020,” building energy use & challenges • History & definitions of energy standards, codes and protocols • Energy policies EPCA & EPAct Need for Building Energy Evaluation • Importance of energy evaluation • Terminology & metrics • Approach to new & existing buildings Weather & Climate Characteristics • Terminology • Earth: orbit, rotation, sun’s radiation • Climate zone characteristics Building Energy Analysis (BEA) • Introduction to Building Energy Analysis • BEA as a tool for decision-making • BEA as a process-oriented approach

MODULE II BUILDING ENERGY ANALYSIS TOOLS 30

Building Energy Analysis Tools, Types & Capabilities • System sizing tools & system performance evaluation tools • Macroscopic & Microscopic analysis tools • Calculation methodologies • BES tools availability & capability • BES tools • Emerging Technologies: BIM, gbXML, Predictive Model Controls, Component based Modeling - eQUEST energy modeling software• Building Envelope • Operating Schedules • Lighting & Daylighting Integration • Occupants, Equipment & Process • HVAC Systems & Controls • Domestic Hot Water Systems

Total Hours –45

REFERENCES:

1. "Best Directory Building Energy Software Tools". www.buildingenergysoftwaretools.com, 2017.
2. Building performance simulation for design and operation. Hensen, Jan.,

Lamberts, Roberto. Abingdon, Oxon: Spon Press, 2011.

3. Clarke, J. A. Energy simulation in building design (2nd Ed.). Oxford: Butterworth-Heinemann, 2001.
4. Clarke, J. A.; Hensen, J. L. M."Integrated building performance simulation: Progress, prospects and requirements". Building and Environment. Fifty Year Anniversary for Building and Environment, 2015.
5. Wilde, Pieter, “Building Performance Analysis”, Chichester: Wiley-Blackwell, (2018).

OUTCOMES:

On completion of this course, students will be able to

- Appreciate the concepts, modeling inputs and analysis methods of building components such a envelope, lighting, occupants, equipment, process loads, HVAC and service hot water systems.
- model building performance using energy simulation software.
- interpret simulation results and troubleshoot errors.
- measure building energy data to calibrate simulation model.
- evaluate EEMs and perform parametric analysis to identify optimal solutions.

CEDY 133	ENERGY RATING	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course will impart knowledge on

- building rating systems

MODULE I **8**

ASHRAE Building Energy Quotient Program - ASHRAE Fundamentals 2009 - ANSI/ASHRAE/IESNA 90.1-2010; 100-2006 - ANSI/ASHRAE 62.1-2010; 55.1-2004 - ANSI/ASHRAE/USGBC/IES Standard 189.1-2009 - State Energy Codes - Greenhouse Gas Emission & Carbon Neutrality

MODULE II **7**

Greenhouse Gas Emission & Carbon Neutrality - CIBSE Applications Manual - ENERGYSTAR Portfolio Manager - COMNET Modeling Guidelines - International Performance Measurement & Verification Protocol - IRS Tax Deduction - Net Zero Energy Buildings - Building Rating Systems (LEED, BREEAM, GGP, GREENSTAR, GREEMARK)

Total Hours –15

REFERENCES:

1. ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers). 2010. ASHRAE Energy Standard 90.1-2010 for Buildings Except Low-Rise Residential. Washington, D.C.
2. GBCI (Green Building Certification Institute). 2012.
3. https://new.usgbc.org/leed
4. https://www.breeam.com

OUTCOMES:

On completion of this course, students will be able to

- Choose materials and techniques for green buildings
- Plan a building for rating as energy efficient structure.

GENERAL MANAGEMENT

CEDY 102	CONDITION ASSESSMENT AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- various causes of failures due to environmental problems and natural hazards.
- assessment procedure for evaluating the distressed structure, materials available for effecting repair and techniques for effective rehabilitation.
- seismic rehabilitation of damaged structures

MODULE I CAUSES FOR FAILURES 9

Causes of distress in structural members – design and material deficiencies – over loading - Embedded Metal Corrosion, Disintegration Mechanisms, Moisture Effects, Thermal Effects, Structural Effects, Faulty Construction - Damages due to earthquake, fire & cyclone - case studies - learning from failures

MODULE II DIAGNOSIS AND ASSESSMENT OF DISTRESS 9

Visual inspection – non-destructive tests – ultrasonic pulse velocity method – rebound hammer technique – ASTM classifications – pullout tests – Bremor test – Windsor probe test – crack patterns- crack detection techniques – Chemical testing - case studies – single and multistorey buildings – Fibreoptic method for prediction of structural weakness

MODULE III MATERIALS FOR REPAIR 9

Strategy & Design, Selection of Repair Materials, Surface Preparation, Bonding repair Materials to Existing concrete, Placement Methods,- Epoxy Bonded Replacement Concrete, Preplaced Aggregate Concrete, Shotcrete/ Gunite, Grouting, Injection Grouting, Micro concrete - methods of corrosion protection - corrosion inhibitors - protective coating materials for rebar and concrete - corrosion resistant steel - cathodic protection

MODULE IV MODERN TECHNIQUES OF RETROFITTING 9

Guniting - jacketing – use of chemicals in repair – application of polymers – ferrocement SIFCON, SIMCON, Fibre reinforced Polymer Composites - rust eliminators and polymer coating for rebars- mortar repair for cracks- shoring and underpinning - strengthening by pre-stressing - case studies –bridges – water tanks

– cooling towers – heritage buildings – high rise buildings.

MODULE V SEISMIC REHABILITATION OF STRUCTURES 9

Guidelines for Seismic Rehabilitation of Existing Buildings, Seismic Vulnerability and Strategies for Seismic Retrofit- case study for a RC building, steel frame building and masonry building.

Total Hours – 45

REFERENCES:

1. ATC- 40: Seismic Evaluation and Retrofit of Concrete Buildings, Vol. 1 & 2.
2. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical, UK, 1991.
3. Emmons, P.H., “Concrete Repair and Maintenance”, Galgotia Publication, 2001
4. FEMA 273; NEHRP Guidelines for the Seismic Rehabilitation of Buildings.
5. Malhotra, V.M. and Carino, N.J., “Handbook on Non-destructive Testing of Concrete”, CRC Press
6. Natarajan C., R. Janardhanam, Shen-En Chen, Ryan Schmidt, Ino-U.S. “Forensic Practices - Investigation Techniques and Technology”, NIT, Tiruchirappalli, 2010.
7. Seible, F. and Calvi, G.M., “Seismic Design and Retrofit of Bridges”, John Wiley, 2005.

OUTCOMES:

On completion of the course, students will be able to

- Specify the causes for distress in structures due to environmental problems and natural hazard.
- Critically diagnosis various the distressed structure and generate a 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.
- Suggest suitable retrofitting and vulnerability strategic methods for seismically damaged structures.

CEDY 140	QUANTITY SURVEYING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- The ability to estimate the quantities of item of works involved in buildings, water supply and sanitary works, road works and irrigation works.
- The concepts of rate analysis and process of tenders
- Valuation engineering and preparation of reports for quantity calculation of various items.

MODULE I QUANTITY SURVEY OF BUILDINGS 9

Introduction, glossary of technical terms, methods and unit of measurement, Items of work – earthwork, Brick work (Modular & Traditional bricks), RCC work, Shuttering, Timber work, Painting, Flooring, Plastering, Boundary wall, various types of arches, paneled and glazed doors, windows, ventilators, handrails, Bar bending schedule, Centre line method, Mid-section formula, Trapezoidal formula, Simpson's rule.

MODULE II QUANTITY SURVEY OF OTHER STRUCTURES 9

Estimating of septic tank, soak pit, sanitary and water supply installations – water supply pipe line, sewer line, tube well open well, flexible and rigid pavements, retaining walls, culverts, irrigation structures – aqueduct, syphon, fall - isolated and combined footings, steel truss, piles and pile-caps.

MODULE III SPECIFICATIONS AND TENDERS 9

Data – schedule of rates – analysis of rates – specifications – sources – preparation of detailed and general specifications – tenders – Tamilnadu tender in transparency act – e tender – preparation of tender notice and document – contracts – types of contracts – drafting of contract documents – arbitration and legal requirements.

MODULE IV VALUATION 9

Necessity – basics of value engineering - value and cost - methods of valuation – capitalized value - scrap value - salvage value - assessed value - sinking fund – depreciation and obsolescence – escalation – value of building – calculation of standard rent – mortgage – lease.

MODULE V REPORT PREPARATION 9

Principles for report preparation – report on estimate of residential building – culvert – flexible and rigid pavement – water supply and sanitary installations – sewer line – tube wells – open wells – retaining wall - irrigation structures – sub structures – steel structures.

Total Hours – 45

REFERENCES:

1. Arbitration and Conciliation Act, 1996
2. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt. Ltd., 2003
3. Kohli, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S.Chand & Company Ltd., 2004
4. Standard Bid Evaluation Form, Procurement of Goods or Works, The World Bank, April 1996.
5. Tamilnadu Transparencies in Tender Act, 1998

OUTCOMES:

On completion of this course, students will be able to

- Calculate quantity of different items of work for building and other structures.
- Calculate rate analysis of various items
- Demonstrate the process of tenders
- valuate various structures
- prepare reports of valuation

CEDY 141	FIRE PROTECTION AND SERVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the concepts of functional design of building for thermal aspects and energy efficiency; especially in tropical climates i.e. in Indian context.
- fenestration design for natural ventilation and day lighting & design of space for external and internal noise control.

MODULE I FIRE PROTECTION 9

Process of combustion in fire, Effect of fire load & ventilation condition on enclosure fire, growth and decay of fire in enclosure Concepts of fire resistant and severity, Effect of fire on materials. Simple Design of elements for given fire resistance.

MODULE II LIFTS & VERTICAL TRANSPORTATION 9

Planning, Fire detection & suppression systems, Smoke venting Lifts & Vertical Transportation: Arrangement of lifts and Design for optimum service condition.

MODULE III HVAC SYSTEM 9

Design Consideration. Basic psychometrics, Air conditioning process & system. Methods of Air Conditioning. Water Supply, Hydraulic design, Storage Distribution, Component of cold & hot water supply system. Waste water & Drainage systems: Fixture units & Design of system and elements of electrical services.

MODULE IV BUILDING MAINTENANCE 9

Definition, Role of building maintenance in construction process Maintenance generators, Expression of Standards, selection of level of maintenance and fixing standards. Planned maintenance: Planning vis-a-vis ado maintenance, schedule & contingency maintenance, levels of planning, planned inspection, etc

MODULE V MAINTENANCE CYCLE 9

Maintenance cycle, maintenance profile, repair & replacement models, statistical methods, decision models, optimal renewal cycle, budgeting etc Effect of design on maintenance, Diagnosis, appraisal, structural defects & various methods of repair.

Total Hours – 45

REFERENCES:

1. Andrew Funess., “Introduction to Fire Safety Management” Routledge publishers. 2017
2. Croome,J.D.&Roberts,B.M.,"AIRCONDITIONING AND VENTILATION OF BUILDINGS VOL-1".Pergamon press. 2007
3. Jain.V.K, “Fire Safety in Buildings” New age publishers. 2010
4. Sesha Prakash.N, “Manual of Fire Safety” CBS Publishers and Distributors Pvt Ltd. 2011

OUTCOMES:

On completion of this course, students will be able to

- Know the importance of fire resistance and its impact
- Plan the optimum service conditions
- Know the importance of design considerations and HVAC systems
- Know the role of building maintenance in construction process
- Understand the impact of design in maintenance.

CEDY 142	LOGISTIC AND SUPPLY CHAIN MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

The course will impart knowledge on

- logistic network design
- product and supply chain design
- technologies for SCM.

MODULE I INTRODUCTION AND LOGISTICS NETWORK DESIGN 9

Definition of logistics and supply chain management, decision phases in a supply chain, objectives of SCM, examples of supply chains, supply chain drivers, supply chain integration, supply chain performance measures. - Role of distribution in supply chain, distribution network design, factors influencing distribution network design, distribution networks in practice, network design in the supply chain, factors influencing the network design, framework for network design, models for facility location and capacity allocation, Impact of uncertainty on network design.

MODULE II COORDINATED PRODUCT AND SUPPLY CHAIN DESIGN 6

General framework - Design for logistics - Standardization - Push-pull boundary - Supplier integration into New Product Development - Keys to effective supplier integration - Mass Customization - Meaning - Mass Customization and Supply Chain Management. –

MODULE III STRATEGIC ALLIANCES AND INVENTORY MANAGEMENT 9

Framework for strategic alliances - Third Party Logistics - 3PL issues and requirements - Retailer - Supplier Partnerships - Issues in Retailer - Supplier Partnerships - Distributor Integration - Types and issues of Distributor Integration. Cycle inventory, economies of scale to exploit fixed costs, quantity discounts, example problems, multi-echelon inventory, safety inventory in supply chain, safety level estimation, supply uncertainty, data aggregation, replenishment policies, managing safety inventory in practice, product availability, optimal level, affecting factors, supply chain contracts - Bull whip effect.

MODULE IV TECHNOLOGIES FOR SCM 6

Information Technology (IT) - Infrastructure - Interface devices - System architecture - Electronic commerce - IT for supply chain excellence - Service oriented architecture - Radio Frequency Identification (RFID) - Impact of internet.

Total Hours –30

REFERENCES:

1. Sadler I, “Logistics and Supply Chain Integration”, Sage Publishers, 2007.
2. Simchi - Levi Davi, Kaminsky Philip and Simchi-Levi Edith, “Designing and Managing the Supply Chain”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2012.
3. Sunil Chopra and Peter Meindl, “Supply Chain Management”, Prentice Hall, New Jersey, 2010.

OUTCOMES:

On completion of this course, students will be able to

- Understand the Inventory management and distribution network.
- Design the network of supply chain Management,
- Coordinate product and supply chain design in logistics.
- Enumerate the various technologies used for supply chain management

CEDY 144	POST DISASTER MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course will impart knowledge on

- Various disaster and hazards.
- Various administrative setup and organization,
- Hazards analysis and emergency facilities.

MODULE I INTRODUCTION AND DISASTER MANAGEMENT 08

Natures and extend of disaster, natural calamities such as earthquake, floods, drought volcanoes, forest fires, coasts hazards, landslides etc. manmade disaster such as chemical and industrial hazards, nuclear hazards, fire hazards etc. – financing relief expenditure, legal aspects, rescue operations. Casualty management, risk management.

MODULE II EMERGENCY MANAGEMENT PROGRAMME 07

Administrative setup and organization, hazard analysis, training of personnel, information management, emergency facilities and equipment necessary public awareness creation, preparation and execution of the emergency management programme.

Total Hours –15

REFERENCES:

1. Johnson.C. Creating an enabling environment for reducing disaster risk: Recent experience of regulatory frameworks for land, planning and building in low and middle-income countries. Global assessment report on disaster risk reduction. ISDR, April 2011.
2. Kuriakose B. Habitat mapping of Thrangambadi: a study of Tharangambadi village in connection with tsunami reconstruction project. Trivandrum, Kerala: South Indian Federation of Fishermen Societies (SIFFS); 2006.
3. Michal Lyons, Theo Schilderman, Camillo Boano editors. Building back better. Delivering people-centered housing reconstruction at scale. Practical Action Publishing: Rugby; 2010.

OUTCOMES:

On completion of this course, students will be able to

- assess the disaster and its impact
- manage the disaster executing emergency management programmes

ADVANCED TOPICS

CEDY 150	ADVANCED TECHNIQUES IN CONSTRUCTION	L	T	P	C
		3	0	0	3

OBJECTIVE:

The course will impart knowledge on

- the latest construction techniques applied to engineering construction for sub structure.
- the technological advancement to construct super structure
- the latest technology to construct special structures
- the rehabilitation and strengthening technique in a challenging environment
- different demolition technique for various purpose

MODULE I SUB STRUCTURE CONSTRUCTION 9

Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation

MODULE II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

MODULE III CONSTRUCTION OF SPECIAL STRUCTURES 9

Geometry control Technique – Part Segmentation Construction - Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers, Steel bridges - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of

articulated structures and space decks.

MODULE IV REHABILITATION AND STRENGTHENING TECHNIQUES 9

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

MODULE V DEMOLITION TECHNIQUES 9

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling

Total Hours : 45

ERENCES

1. National Building Code of India, Part-IV and VII – 2006.
2. Peter.H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008.
3. Roger Greeno , Mr R. Chudley , Mr Mike Hurst , Mr Simon Topliss, Advanced Construction Technology 5th edition, Pearson Publication, 2012
4. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.

OUTCOMES:

On completion of this course, students will be able to

- Know the modern construction techniques to be used in the sub structure.
- learn the new advancements in the Super structure
- Apply different techniques in construction of bridge, tower and transmission lines.
- investigate in the Rehabilitation and strengthening technique
- Extrapolate the demolition techniques used in the construction.

CEDY 151	AIRBORNE AND TERRESTRIAL LASER SCANNING SYSTEM FOR BUILDINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- the concepts of space borne radar, airborne laser sensors, terrestrial laser scanners and their working principle
- data acquisition, data pre processing, post processing techniques and possible applications in recent trends

MODULE I SPACE BORNE RADAR AND LIDAR ALTIMETER 9

Principle and Properties of LASER- Range Finder, DIAL and Doppler LiDAR – Platforms: Terrestrial, Airborne and Space borne LiDAR – Space Borne LiDAR Missions – Space Borne Radar Altimeter for mapping Sea Surface Topography – Space Borne Laser Altimeter and Applications

MODULE II AIRBORNE LASER SCANNERS 9

Airborne Topographic Laser Scanner – Ranging Principle – Pulse Laser and Continuous Wave Laser – First Return and Last Return – Ellipsoidal and Geoidal Height – Typical parameters of a Airborne Laser Scanner (ALS) – Specifications of Commercial ALS – Various Application Domains of ALS – Merits of ALS in comparison to Levelling, GPS leveling, Photogrammetry and Interferometry – Components of ALS – GPS, IMU, LASER Scanner, Imaging Device, Hardware and Software

MODULE III TERRESTRIAL LASER SCANNERS 9

Terrestrial Laser Scanners(TLS) – Working Principle – TLS scanner parameters - Commercial TLS Specifications – 3D point cloud - 3D terrestrial laser scanner for managing existing buildings - Application of 3D TLS in bridge inspection

MODULE IV DATA ACQUISITION AND PRE PROCESSING 9

Various Scanning Mechanism – Synchronization of GPS, IMU and ALS Data – Reflectivity of terrain objects – Laser Classification – Class I to Class IV Laser – Eye Safety – Flight Planning– Determination of various data acquisition parameters – Swath Width, Point Density, Number of Strips, Area Covered, Point Spacing – Data Processing – Determination of flight trajectory – LIDAR data formats.

MODULE V POST PROCESSING AND APPLICATIONS 9

Post Processing – Geo location of Laser Foot Prints – Various Co-ordinate Transformations involved – Strip Adjustment – Filtering – Ground Point filtering – Digital Elevation Model – Error Sources – Overview of LIDAR Applications in various domains – Forestry Applications – Feature extraction, Ortho images - 3D city models - Corridor Mapping Applications

Total Hours – 45

TEXT BOOKS:

- George Vosselman, Airborne and Terrestrial Laser Scanning, Taylor & Francis, 2010
- Jie Shan and Charles K. Toth, Topographic Laser Ranging and Scanning – Principles and Processing, CRC Press, Taylor & Francis Group, 2009

REFERENCES:

- Roger Read and Ron Graham, Manual of Aerial Survey: Primary Data Acquisition, Whittles Publishing, 2002
- Zhilin Li, Qing Zhu, Chris Gold, Digital terrain modeling: principles and methodology, CRC Press, 2005

OUTCOMES:

On completion of this course, students will be able

- To explain the concepts of space borne radar and altimeter and their working principle
- To explore the available types of airborne laser sensors and their components
- To apply the fundamentals of terrestrial laser scanners and their applications
- To evaluate the process of data acquisition, data pre processing techniques
- To identify the post processing functions and possible applications in recent trends

CEDY 152	OPERATIONS RESEARCH AND DECISION THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course will impart knowledge on

- Concepts of operations research & Decision strategies
- Game Theory
- Linear Programming & Dynamic Programming
- Network Analysis & Queuing Theory
- Transportation & Assignment Models

MODULE I INTRODUCTION 9

Operations Research - Origin, development, scope, characteristics and limitation. Phases of OR - Classification of OR models.

Decision strategies - Decision under certainty, risk and uncertainty - Formulation - Decision criteria and decision under competitive situations-Decision trees.

MODULE II GAME THEORY 7

Classification of games - two person zero sum games, formulation of pay - off matrix - saddle points - games with pure and mixed, strategies - value of the game.

Solution to 2 x 2, 2 x n and m x n pay - off matrix: - Graphical, algebraic and linear programming methods.

MODULE III LINEAR PROGRAMMING & DYNAMIC PROGRAMMING 10

Linear Programming Formulation, general and standard forms of LPP, dual of LPPs. Solution methods -Graphical method, Simplex techniques, Big M method and Two phase methods.

Dynamic Programming Introduction – Recursive equation approach, solution of Discrete DPP, Solution of LPP by Dynamic Programming

MODULE IV NETWORK ANALYSIS & QUEING THEORY 10

Network Analysis: Introduction- Minimum Span Problems, Shortest- Route problems, Maximal- Flow Problems

Queuing Theory/Waiting Line Theory: Introduction - General structure of a queuing system – operating characteristics of queuing system.

Waiting line models: Poisson - Exponential single server model – infinite and finite population, Poisson - Exponential multiple server model – infinite population.

MODULE V TRANSPORTATION & ASSIGNMENT MODELS 9

Transportation Models: Introduction - Balanced and unbalanced transportation problems - Methods of finding initial and optimal solution: NWC method, Least cost method, Vogel's approximation method, and MODI method.

Assignment Models: Introduction - Solution methods – Hungarian assignment method.

Total Hours – 45

REFERENCES:

1. Frank Harrison, E., the Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
2. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.
4. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
5. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.

OUTCOMES:

On completion of this course, students will be able to

- Apply the concepts of operations research & decision Theory for various applications
- Understand game theory and Create matrix to solve problems
- Formulate solutions by using Linear & Dynamic programming.
- Apply the concepts of network analysis and queuing theory to solve management problems
- Develop solutions using transportation and Assignment models

CEDY 153	LEAN TOOLS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The course will impart knowledge on

- Lean construction tools using different software's
- Master scheduling, phase full planning and work planning
- VSM template, VSM planning, VDM alternatives and improve decision outputs that improve insight and reporting

MODULE I LEAN TOOLS 6

Lean Construction tools – waste detection tools – waste processing tools – waste response tools – Muda walk - Pareto - 5s

MODULE II LAST PLANNER SYSTEM (LPS) 9

LPS - Master Scheduling (MS) – Major milestones and long-lead items - Phase Pull Planning (PPP) – A target condition or future state - Six Week Look-ahead Planning (6WLA) – Make work ready and re-plan as required - Weekly Work Planning (WWP) – Unencumbered work promises for the next week - Percent of Plan Complete (PPC)

MODULE III VALUE STREAM MAPPING (VSM) 9

VSM – Applications - Understanding the scope of the value stream - Form a Team to Create the Lean Value Stream Map - The Kaizen Kick-Off – VSM Planning - The Process Family – VSM Planning - Identifying Similarities - Creating the Current State Map – Creating the Basic VSM Template - Creating the Future State Map - Creating the VSM Draft Plan

MODULE IV VISUAL DECISION PLOTTER (VDP) 6

VDM - Alternatives – Measure and illustrate the importance of each option - Factors & Criteria – Sharpen thinking to reveal the most relevant details- Attributes – Simplify deciding by choosing from the accrued value illustrated - Advantages – Record rationale with visual decision outputs that improve insight and reporting

Total Hours –30

REFERENCES:

1. Hopp, W. J., and Spearman, M. L., Factory Physics, Third Edition, Waveland Press, Long Grove, II, 2011

2. Liker, J. K., “The Toyota Way”, McGraw-Hill, New York, NY, 2011
3. Liker, J. K., and Meier, D., “The Toyota Way Fieldbook”, McGraw-Hill, New York, NY, 2005
4. Readings at http://www.leanconstruction.org/readings.htm

OUTCOMES:

On completion of this course, students will be able to

- Select the appropriate lean construction tools
- Implement last planner system in construction projects.
- Demonstrate and explain about different scheduling
- Analyze the importance of VSM planning and advantages of VDP

CEDY 154	AUGMENTED REALITY /VIRTUAL REALITY APPLICATIONS IN CONSTRUCTION	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course will impart knowledge on

- different requirements of virtual reality and application in the construction industry
- distinguishing augmented reality with the virtual reality

MODULE I VIRTUAL REALITY IN CONSTRUCTION 8

The historical development of VR - Scientific landmarks Computer Graphics - Real-time computer graphics - Flight simulation- Virtual environments, Requirements for VR - benefits of Virtual reality – Applications in construction – case study

MODULE II AUGMENTED REALITY IN CONSTRUCTION 7

basics of augmented reality - how and why it was developed - how it compares to and differs from its technological cousin, virtual reality - hardware needed to view AR content - benefits of Augmented reality – Applications in construction – case study

Total Hours –15

REFERENCES:

1. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
2. Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
4. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005.
5. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Meging Real and Virtual Worlds”, 2005.

OUTCOMES:

On completion of this course, students will be able to

- Demonstrate and respond the importance of virtual reality in construction management.
- Formulate a deep understanding about the augmented reality and its application in industry.

CEDY 155 WAVE HYDRODYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the fundamentals of fluid mechanics relevant to ocean wave theory.
- To provide sufficient knowledge about the various classification of ocean waves
- To enhance the student interest in wave phenomena and its application parameters.

MODULE I CONSERVATION OF MASS, MOMENT AND ENERGY 09

Basic fluid dynamics - Conservation of mass and momentum -Euler Equation - Bernoulli's equation - Potential flow - Stream function.

MODULE II CLASSIFICATION OF OCEAN WAVES 09

Classification of water waves - Two-dimensional wave equation - Boundary Conditions and solutions - Dispersion relations - Constancy of wave period. - Wave characteristics

MODULE III WAVE KINEMATICS 09

Wave celerity - Water particle velocities – Accelerations - Displacements and Pressures - Approximations for deep and shallow water conditions - Integral properties of waves - Mass flux - Energy and Energy flux - Group speed - Momentum and Momentum flux.

MODULE IV WAVE TRANSFORMATION 09

Shoaling - Bottom friction and Damping – Refraction - Reflection and Diffraction. Wave breaking - Type of breaking - Surf similarity parameter - Keulegan Carpenter Number - Ursell parameter - Reynolds number.

MODULE V FORCES & WAVE THEORY 09

Currents-Classification - Behaviour - Design Criteria – Forces - Wave forces - Morison equation - Wave loads on vertical, inclined and horizontal cylinders - Mass Transport Velocity - Introduction to Random and Directional waves -Small amplitude waves - Finite amplitude waves - Introduction to Non-linear wave theories - Stokian,

Solitary and Cnoidal wave theories - Diffraction theory – Wave slamming and Slapping

Total Hours: 45

TEXT BOOKS:

1. Sarpkaya, T. and Isaacson, M., Mechanics of Wave Forces on Offshore Structures, Van Nostrand Reinhold Co., NewYork,1981.
2. Sorenson, R.M., Basic Coastal Engineering, Springer Publication, New York, 2010.
3. Sundar V.,Ocean Wave Mechanics - Applications in Marine Structures, John Wiley & Sons Ltd,2016.

REFERENCES:

1. Dean R.G. and Dalrymple, R.A., Water Wave Mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey,1994.
2. Shore Protection Manual Volume I and II, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington, 1984.
3. Sorenson, R.M., Basic Coastal Engineering, Springer Publication, New York, 2010.
4. Umesh A Korde and John Ringwood., Hydrodynamic Control of Wave Energy Devices; Cambridge University Press, England, 2016.

OUTCOME:

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

- describe the fundamental principles of equations of motion of fluid flows.
- apply the analytical concepts to analyse a range of two-dimensional engineering fluid flows, with appropriate choice of simplifying assumptions and boundary conditions.
- analyse the wave flow using principle of wave kinematics.
- investigate the critical evaluation of the effects of significant flow and geometric parameter applying both hydrodynamic theory and knowledge for other disciplines relevant to the problem.
- assess the wave techniques and to analyse the wave forces.

VALUE ADDED PROGRAMME

CEDY 260	ETABS	L	T	P	C
		0	0	2	1

OBJECTIVES:

The course will impart knowledge on

- ETABS Software

MODULE I INTRODUCTION TO ETABS 8

Modeling of a building structure : an overview, Objectives and strategies - Introduction to ETABS: Its history and current capabilities - ETABS GUI - Modeling overview from start to finish by a simple example - Analysis Flavors - Linear, Non- linear

MODULE II OBJECT BASED MODELLING 7

Major differences from element based modeling - Good work methods - Modeling Objects of ETABS viz, point, line, area and link objects - Polymorphism of objects - Point Objects - Line objects - Area objects - Link Objects - All type of objects present in the same model.

MODULE III LOAD CASES & ANALYSIS 8

Setting up load cases for analysis - Overview of analysis available in ETABS viz. Linear/Nonlinear cases and types such as static, Spectrum, buckling, modal, time history, staged analysis etc - Simple examples of each type of analysis - Non- linear analysis to account for contact problems and geometric non- linearity like P- Delta analysis, Staged analysis etc - Non- linear Pushover analysis - An overview, objectives and strategies - Detailed example of pushover analysis, interpretation of results and drawing the inferences - Discrete non- linear element - The usefulness of such non- linear elements - Concept of energy dissipation. Analysis with dampers and base isolators - Base Isolation basics.

MODULE IV DESIGN OF VARIOUS STRUCTURES 7

Design of concrete frames - Design of Steel frame elements - Modeling and design of shear walls - Foundation modeling importance, cases - Practical hints on modeling to satisfy the building codes - Certain non- linear analyses related with P- Delta - Design of shell elements like base mats and flat slabs

Total Hours –30

TEXT BOOKS:

RAGHUNANDAN M H “Analysis of Structural Elements by STAAD Pro for beginners [with RCC design]: 2nd Edition, 2018

REFERENCES:

Prof. Sham Tickoo **“**Exploring Bentley STAAD.Pro CONNECT Edition, 3rd Edition by CADCIM Technologies, 2018

OUTCOMES:

On completion of this course, students will be able to

- model a building using ETABS software
- create an element based model
- load and analyze linear and non linear cases
- design various structures using ETABS

CEDY 261	REVIT ARCHITECTURE	L	T	P	C
		1	0	2	2

OBJECTIVES:

The course will impart knowledge on

- REVIT Architecture Software
- 3D Modeling of various structures

MODULE I INTRODUCTION TO REVIT 10

Introduction to BIM & Revit, Parametric relationship, Bidirectional associativity , Types of files, GUI, Setting Units, Creating levels, Placing walls, doors, windows to develop a layout, Draw tools

Instance and Type parameters - defining new basic wall type, door & window with specification, wall editing and adding new materials from material browser, Editing wall profile, wall opening

Modification tools-align, offset, mirror draw and pick axis, split element ,split with gap, linear and radial array , move ,rotate ,trim ,copy ,pin & delete

MODULE II WALLS & ROOF 11

Adding wall sweep and reveal - Creating new profiles for sweep and reveal, working with family file for profile Types of wall-stacked, compound, curtain, types of curtain walls placing grids and mullions, Adding door in a curtain wall.

Roof Types- soffit, fascia, gutter, Model line, model text and model group, types of elements - model, detail, datum, and views. Model in place-selecting category, modeling tools- Sweep, revolve, extrusion, blend, swept blend, reference plane, adding type & instance parameters.

Developing roof - By Roof print, flat, sloped, gabled roof, join roof, Roof by extrusion, setting work plane, roof, dormer opening, attach wall to roof

MODULE III ARCHITECTURAL & STRUCTURAL FLOOR 12

Creating and editing architectural & structural floor - Creating new material, Developing ceiling plan, adding ceiling, hosted components, interior space planning, developing interior 3D image using camera & rendering.

Adding Room and Area definitions to develop room and area plan, Applying color scheme, color fill legend, exporting Room & area report. Controlling Visibility, generating furniture plan

Connecting floors with ramps -methods, floor editing by sub elements. Converting single storey structure to multi storey model with shaft openings Insert-Working with imported/linked cad layout, Autodesk seek

Circulation tools:-Railing, Creating and editing new type of railing with new profiles and balusters, Stairs- types & methods

MODULE IV 3D VIEW & WALK THROUGH 12

Generating 3D view - using camera, editing view, Rendering-artificial, daylight, render-in-cloud, exporting images. Landscaping-Top surface creation and editing, placing site and parking component, property line, building pad, sub region, graded region.

Walkthrough- editing key frames, speed, view range, exporting walkthrough Free form development using massing, In place mass, Place mass, adding walls, floors and roof by face, Curtain system

Creating new family- file for Furniture with family types with constraints and parameters. Creating new views- Plan, Section, elevation, Plan region, callout, legend, view range, underlay, and visibility template.

Creating and exporting schedules - material take off, Export to excel. Export – dwg /dxf/fbx/ifc/gbxml, Creating sheet, title block, editing title block, guide grid, placing views on sheet, view port, moving view title, creating duplicate views, creating new title block. Print, Export

Total Hours –45

TEXT BOOKS:

1. Mastering Autodesk Revit 2017 for Architecture 1st Edition, by Marcus Kim , Lance Kirby , Eddy Krygiel

REFERENCES:

1 Autodesk Revit 2018 Architecture Fundamentals - Metric: Autodesk Authorized Publisher Ascent - Center for Technical Knowledge

OUTCOMES:

On completion of this course, students will be able to

- apply the features of REVIT architecture
- create walls & roof using the software
- Connect floors, structural elements & architectural elements using software
- Generate 3D view and animate walkthrough using REVIT architecture.

GENERAL ELECTIVES

GEDY 101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate 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.

GEDY 102	SOCIETY, TECHNOLOGY & 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.

GEDY 103	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.

GEDY 104	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", Prentice 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.

GEDY 105	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 SalenTekinba, 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

GEDY 106	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.

GEDY 107	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

GEDY 108 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

GEDY 109 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.

GEDY 110	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–Breakeven 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

GEDY 111 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. LaureneFausett, “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

GEDY 112 JAVA PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods with ability handle abnormal conditions.
- To learn to work with various string methods and collection framework.
- To establish a connection to database from java application.
- To understand why Java is useful for the designing web applications.
- To design a graphical user interface (GUI) with Java Swing.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 06

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

MODULE II METHODS AND CLASSES 08

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

MODULE III STRING HANDLING AND COLLECTIONS 07

String Handling - Special String Operations - String Literals- String Conversion - Collections Overview - The Collection Interfaces -The Collection Classes - Accessing a collection Via an Iterator - Working With Maps, Comparators.

MODULE IV DATABASE CONNECTIVITY 08

JDBC - JDBC Driver Types - JDBC Packages - Database Connection - Associating the JDBC/ODBC Bridge with the Database - Statement Objects – Result Set - Transaction Processing – Metadata - Exceptions.

MODULE V SERVER PROGRAMMING 09

The Life Cycle of a Servlet - Using Tomcat for Servlet Development -The Servlet API - Handling HTTP Requests and Responses - Using Cookies - Session Tracking - Java Server Pages (JSP)-Session Objects

MODULE VI SWING PROGRAMMING 07

Concepts of Swing - Java Foundation Class (JFC) - Swing Packages and Classes - Working with Swing - Swing Components

L – 45; TOTAL HOURS-45

REFERENCES :

1. Herbert Schildt, “Java The Complete Reference”, 11th Edition, McGraw Hill, 2018, ISBN: 9781260440249.
2. Joshua Bloch , “Effective Java Paperback”,3rd Edition, Addison Wesley,2017,ISBN: 978-0134685991.
3. E Balagurusamy, “Programming with Java”, 6th Edition, Tata Mcgraw Hill, 2019,ISBN: 978-9353162344.

OUTCOMES:

Students who complete this course will be able to

- Understand the fundamentals java programming language
- Use the Java programming language for various programming technologies.
- Perform various string operations on any given text from user.
- Connect any database with java program and manipulate the contents.
- Write a server side programming which can evaluate the input and respond to user request
- Develop user interface using java swings.

GEDY 113	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To study the control statements and string functions of python.
- To practice python data structures - lists, tuples, dictionaries.
- To organize input/output with files in Python.
- To learn the python tools as well as Unicode process.
- To explore advance python including decorators and metaclasses.
- To integrate python with embedded systems.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 07

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

MODULE II LISTS, TUPLES AND DICTIONARIES 08

Lists - list operations - list slices - list methods - list loop – mutability- aliasing - cloning lists - list parameters - Tuples: tuple assignment- tuple as return value- Dictionaries- operations and methods- advanced list processing - list comprehension- selection sort - insertion sort- merge sort- histogram.

MODULE III FILES, MODULES AND PACKAGES 08

Files and exception - text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - word count- copy file.

MODULE IV UNICODE AND BYTE STRINGS 07

String basics - coding basic strings –coding Unicode strings- 3.X bytes objects- 3.X/2.6+ byte array object- text and binary files – Unicode files

MODULE V DECORATORS AND METACLASS 08

Decorator basics- coding function decorators- coding class decorators – managing functions and classes –the metaclass model- declaring metaclasses-coding metaclasses-inheritance and instance-metaclass methods

MODULE VI 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 – 45; Total Hours : 45

REFERENCES :

1. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016, ISBN-13:978-1491939369.
3. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
5. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
6. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
7. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES :

Students to complete this course will be able to

- Implement date and time function programming using python.
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python Programs.
- Instrument the unicode process using python tools
- Build advance python programs using decorators and metaclass.
- Develop embedded system with python programming.

GEDY 114 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. AjitParulekar 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

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

GEDY115 RESEARCH AND PUBLICATION ETHICS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the philosophy of science and ethics, research integrity and publication ethics. To identify research misconduct and predatory publications.
- To understand indexing and citation databases, open access publications, research metrics (citations, h-index, impact Factor, etc.).
- To understand the usage of plagiarism tools.

MODULE I PHILOSOPHY AND ETHICS **4**

Introduction to philosophy – definition - nature and scope – concept - branches – Ethics definition – moral philosophy – nature of moral judgements and reactions.

MODULE II SCIENTIFIC CONDUCT **4**

Ethics with respect to science and research –. Intellectual honest and research integrity – Scientific misconducts – falsification, fabrication, and plagiarism – Redundant publications – duplicate and overlapping publications, salami slicing – Selective reporting and misrepresentation of data.

MODULE III PUBLICATION ETHICS **7**

Publication ethics: definition, introduction and importance – Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. –. Conflicts of interest – Publication misconduct: definition, concept, problems that lead to unethical behavior and vice verse, types – Violation of publication ethics, authorship and contributor ship – Identification of publication misconduct, complaints and appeals – Predatory publishers and journals.

PRACTICALS

OPEN ACCESS PUBLISHING **4**

Open access publications and initiatives – SHERPA/RoMEO online resourse to check publisher copyright and self-archiving policies – Software tool to identify predatory publications developed by SPPU – Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

PUBLICATION MISCONDUCT **4**

Group Discussions – Subject specific ethical issues, FFP, authorship – Conflicts of

interest – Complaints and appeals: examples and fraud from India and abroad – Software tools Use of plagiarism software – Turnitin, Urkund – other open source software tools.

DATABASES AND RESEARCH METRICS **7**

Databases – Indexing Databases – Citation Databases – Web of Science Databases Scopus, etc.

Research Metrics – Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score –

Metrics: h-index, g index, i10 index, altmetrics

L – 15 ; P – 15 ; TOTAL HOURS –30

REFERENCES:

1. Bird, A. (2006). *Philosophy of Science.* Routledge.
2. Macintyre, Alasdair (1967) *A Short History of Ethics.* London.
3. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978- 9387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being*
5. *A Scientist: A Guide to Responsible Conduct in Research: Third Edition.* National Academies Press. Resnik, D. B. (2011). What is ethics in research & why is it important. *National Institute of Environmental Health Sciences,* 1-10. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
6. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a
7. Indian National Science Academy (INSA), Ethics in Science Education, Research and Govemance(2019), ISBN:978-81-939482- l-7. http://www.insaindia.res.in/pdf/EthicsBook.pdf

OUTCOMES:

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

- Describe and apply theories and methods in ethics and research ethics
- Understand the overview of important issues in research ethics, like responsibility for research, ethical vetting, and scientific misconduct.
- Present arguments and results of ethical inquiries.