# UNIVERSITY VISION AND MISSION

## VISION

B.S. Abdur Rahman Institute of Science & Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

## MISSION

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

# VISION AND MISSION OF THE DEPARTMENT OF CIVIL ENGINEERING

## VISION

To be a leading Department for Education, Training and Research in Civil Engineering for a better future and 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 AND OUTCOMES
# M.Tech. (Construction Engineering & Project Management)

## PROGRAMME EDUCATIONAL OBJECTIVES

- To educate graduates the concepts and practices of management in the construction industry.
- To impart organizational and leadership qualities for effective management of construction projects with ethical responsibility.
- To equip the graduates with knowledge, research and practical skills in modern construction practices and techniques giving importance to sustainable development.
- To provide necessary knowledge and skills in accounting, financing, risk analysis and contracting.
- To train the graduates in the use of relevant software packages for planning, scheduling, executing and controlling of construction projects and inculcate an urge for 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 theoretical and practical aspects of project management techniques to achieve project goals.
- possess organizational and leadership capabilities for effective management of construction projects with ethical responsibility
- be able to apply knowledge and skills of modern construction practices and techniques incorporating sustainable practices through research.
- have necessary knowledge and skills in accounting, financing, risk analysis and contracting.
- be capable of using relevant software packages for planning, scheduling, executing and controlling of construction projects and update themselves in areas relevant to their career.
- function effectively both individually and as a part of a professional team exhibiting good communication skills.

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

# REGULATIONS 2013
# FOR
# M.TECH. DEGREE PROGRAMMES

# B.S. ABDUR RAHMAN UNIVERSITY, CHENNAI 48.
# REGULATIONS - 2013 FOR M.TECH / MCA / M.Sc. DEGREE PROGRAMMES

## 1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

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

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

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

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

v) **"Academic Council"** means the Academic Council of this University.

vi) **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S.Abdur Rahman University.

vii) **"Dean (Student Affairs)"** means Dean(Student Affairs) of B.S.Abdur Rahman University.

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

## 2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

### 2.1 P.G. Programmes Offered

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

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

## 2.2 MODES OF STUDY

### 2.2.1 Full-time

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

**2.2.2** A full time student, who has completed all non-project courses desiring to do the Project work in part-time mode for valid reasons, shall apply to the Dean (Academic Affairs) through the Head of the Department, if the student satisfies the clause 2.3.4 of this Regulation. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

### 2.2.3 Part time - Day time

In this mode of study, the students are required to attend classes for the courses registered along with full time students.

### 2.2.4 Part time - Evening

In this mode of study, the students are required to attend normally classes in the evening and on Saturdays, if necessary.

**2.2.5** A part time student is not permitted to convert to full time mode of study.

## 2.3 ADMISSION REQUIREMENTS

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

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

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

**2.3.4** A student eligible for admission to M.Tech. Part Time / Day Time programme shall have his/her permanent place of work within a distance of 65km from the campus of this Institution.

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

## 3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

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

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

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

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

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

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

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

## ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

| Sl. No. | Name of the Department | P.G. Programmes offered | Qualifications for admission |
|---|---|---|---|
| 01. | Civil Engineering | M.Tech. (Structural Engineering) | B.E / B.Tech. (Civil Engineering) / (Structural Engineering) |
| | | M.Tech. (Construction Engineering and Project Management) | |
| 02. | Mechanical Engineering | M.Tech. (Manufacturing Engineering) | B.E. / B.Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering) |
| | | M.Tech. CAD / CAM | |
| 03. | Polymer Engineering | M.Tech. (Polymer Technology) | B.E./ B.Tech. degree Mech./Production/ Polymer Science or Engg or Tech / Rubber Tech / M.Sc (Polymer Sc./ Chemistry Appl. Chemistry) |
| 04. | Electrical and Electronics Engineering | M.Tech. (Power Systems Engg) | B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation) |
| | | M.Tech. (Power Electronics & Drives) | |
| 05. | Electronics and Communication Engineering | M.Tech. (Communication Systems) | B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation) |
| | | M.Tech.(VLSI and Embedded Systems) | B.E./ B.Tech. in ECE / Electronics / EIE / ICE / EEE |
| | | M.Tech.(Signal Processing) | |
| 06. | ECE Department jointly with Physics Dept | M.Tech. (Optoelectronics and Laser Technology) | B.E./B.Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc (Physics / Materials Science / Electronics / Photonics) |
| 07. | Electronics and Instrumentation Engineering | M.Tech. (Electronics and Instrumentation Engineering) | B.E./ B.Tech. (EIE/ICE/Electronics/ECE/ EEE) |
| 08. | Computer Science and Engineering | M.Tech. (Computer Science and Engineering) | B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics) MCA |
| | | M.Tech. (Software Engineering) | B.E. / B.Tech. (CSE / IT) MCA |
| | | M.Tech (Network Security) | B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics) MCA |
| | | M.Tech (Computer and Predictive Analytics) | |
| | | M.Tech. (Computer Science and Engineering with specialization in Big Data Analytics) | |
| 09 | Information Technology | M.Tech. (Information Technology) | B.E /B.Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics) MCA |
| | | M.Tech. (Information Security & Digital Forensics) | |

## ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

| Sl. No. | Name of the Department | P.G. Programmes offered | Qualifications for admission |
|---|---|---|---|
| 10 | Computer Applications | M.C.A. | Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level |
| | | M.C.A. (Full Time) – (Lateral Entry) | B.Sc Computer Science / B.Sc Information Technology / B.C.A |
| | | M.Tech. (Systems Engineering and Operations Research) | BE / B.Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A. |
| | | M.Tech. (Data & Storage Management) | |
| 11 | Mathematics | M.Sc. (Actuarial Science) | Any Degree with Mathematics / Statistics as one of the Subjects of Study. |
| | | M.Sc. Mathematics | B.Sc. (Mathematics) |
| 12 | Physics | M.Sc.(Physics) | B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation) |
| | | M.Sc. (Material Science) | |
| 13 | Chemistry | M.Sc.(Chemistry) | B.Sc (Chemistry) of B.Sc. (Applied Science) |
| 14 | Life Sciences | M.Sc. Molecular Biology & Biochemistry | B.Sc. in any branch of Life Sciences |
| | | M.Sc. Genetics | |
| | | M.Sc. Biotechnology | |
| | | M.Sc. Microbiology | |
| | | M.Sc. Bioscience | |

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

| Programme | Minimum prescribed credit range |
|---|---|
| M.Tech. | 75 to 85 |
| M.C.A. | 120 to 130 |
| M.Sc. | 75 to 85 |

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

* One credit for one lecture period per week
* One credit for one tutorial period per week
* One credit each for seminar/practical session/project of two or three periods per week
* One credit for two weeks of industrial internship.

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

| P.G. Programme | Non-project Semester | Project semester |
|---|---|---|
| M.Tech. (Full Time) | 15 to 29 | 12 to 20 |
| M.Tech. (Part Time) | 6 to 18 | 12 to 16 |
| M.C.A. (Full Time) | 15 to 29 | 12 to 20 |
| M.Sc. (Full Time) | 15 to 25 | 12 to 20 |

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

**3.10** A student may be permitted by the Head of the Department to choose electives offered from other PG programmes either within the Department or from other Departments up to a maximum of three courses during the period of his/her study, provided the Heads of the Departments offering such courses also agree.

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

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

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

## 3.14 PROJECT WORK/THESIS/DISSERTATION

**3.14.1** Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the concerned Department.

**3.14.2** A student may however, in certain cases, be permitted to work for the project in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review committee meetings for evaluating the progress.

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

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

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

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

**3.14.7** A student who has acquired the minimum number of total credits prescribed in the Curriculum for the award of Masters Degree will not be permitted to enroll for more courses to improve his/her cumulative grade point average (CGPA).

## 4.0 CLASS ADVISOR AND FACULTY ADVISOR

## 4.1 CLASS ADVISOR

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

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

## 4.2 FACULTY ADVISOR

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

## 5.0 CLASS COMMITTEE

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

i. Teachers of all courses of the programme

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

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

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

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

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

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

**5.4** The Class Committee is required to meet at least thrice in a semester, first within a week of the commencement of the semester, second, after the first

assessment and the third, after the semester-end examination to finalize the grades.

## 6.0 COURSE COMMITTEE

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

## 7.0 REGISTRATION AND ENROLMENT

**7.1** For the first semester every student has to register and enroll for all the courses.

**7.2** For the subsequent semesters registration for the courses will be done by the student during a specified week before the semester-end examination of the previous semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should consult his/her Faculty Adviser for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Adviser.

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

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

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

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

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

## 8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

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

## 9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

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

| Programme | Minimum No. of credits to be earned to enroll for project semester |
|---|---|
| M.Tech. (Full time) | 18 (III semester) |
| M.Tech. (Part time) | 18 (V semester) |
| M.C.A. (Full time) | 45 (V semester) |
| M.C.A. (Full time) – (Lateral Entry) | 22 (V semester) |
| M.Sc. (Full time) | 30 (IV semester) if project is in IV semester<br>18 (III semester) if project is in III semester |

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

## 10.0 DISCIPLINE

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

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

**10.3** Every student should have been certified by the HOD that his / her conduct and discipline have been satisfactory.

## 11.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

Attendance rules for all Full-time programme and Part-time – Day-time programmes are given in the following sub-clause.

**11.1** A student should secure not less than 75% overall attendance in that semester taking into account the total no. of periods in all courses put together attended by the student as against the total no. of periods in all courses offered during that semester. If a student who could secure overall attendance between 65% and 75% only in a particular semester due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level sports events with prior permission from the Officials concerned shall be given exemption from the prescribed attendance requirement and he / she shall be permitted to appear for the current semester examinations.

***The students who do not fulfill the above attendance requirement will not be permitted to write the semester end examination and will not be permitted to move to next semester. Such students should repeat all the courses of the semester in the next Academic year.***

**11.2** The faculty member of each course shall furnish the cumulative attendance details to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less than 75% overall attendance, to the Dean (Academic Affairs) through the Head of the Department / School Dean. Thereupon, the Dean (Academic Affairs) shall issue orders preventing students from appearing for the semester end examination of all the courses of that semester.

**11.3** A student who is awarded "U" grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course whenever the course is offered. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the semester-end (re-do) examination. If any student obtained "U" grade, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

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

## 12.0 ASSESSMENTS AND EXAMINATIONS

**12.1** The following rule shall apply to the full-time and part-time PG programmes (M.Tech./ M.C.A. / M.Sc.)

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

**12.2** There shall be one examination of three hours duration, at the end of the semester, in each lecture based course.

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

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

## 13.0 WEIGHTAGES

**13.1** The following shall be the weightages for different courses:

i) **Lecture based course**

| | |
|---|---|
| Two continuous assessments | - 50% |
| Semester-end examination | - 50% |

ii) **Laboratory based courses**

| | |
|---|---|
| Laboratory work assessment | - 75% |
| Semester-end examination | - 25% |

iii) **Project work**

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

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

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

## 14.0 SUBSTITUTE EXAMINATION

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

**14.2** A student who misses any assessment in a course shall apply in a prescribed form to the Dean (Academic Affairs) through the Head of the department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

## 15.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

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

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

Flexible range grading system will be adopted

**"W"** denotes withdrawal from the course.

**"U"** denotes unsuccessful performance in a course.

**"AB"** denotes absent for the semester end examination

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

**15.3** A course successfully completed cannot be repeated for any reason.

## 16.0 AWARD OF LETTER GRADE

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

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

## 17.0 DECLARATION OF RESULTS

**17.1** After finalization by the Class Committee as per clause 16.1 the Letter grades awarded to the students in the each course shall be announced on the

departmental notice board after duly approved by the Controller of Examinations.

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

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

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

## 18.0 COURSE REPETITION AND ARREARS EXAMINATION

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

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

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

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

**18.5** If a student with “U” or “AB” grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she

will not be permitted to write the semester end examination and his / her earlier 'U' grade and continuous assessment marks shall continue.

## 19.0 GRADE SHEET

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

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

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

(iii) the total credits earned in that semester.

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

**19.2** The GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i} \qquad Where\ \ n = number\ of\ courses$$

where $C_i$ is the number of credits assigned for $i^{th}$ course $GP_i$ - Grade point obtained in the $i^{th}$ course For the cumulative grade point average (CGPA) a similar formula is used except that the sum is over all the courses taken in all the semesters completed up to the point of time.

**'W' grade will be excluded for GPA calculations.**

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

**19.3** Classification of the award of degree will be as follows:

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

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

## 20.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

**20.1** 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

**20.2** The award of the degree must be approved by the University.

## 21.0 POWER TO MODIFY

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

# CURRICULUM & SYLLABI FOR M.TECH. (CONSTRUCTION ENGINEERING & PROJECT MANAGEMENT)

## (FOUR SEMESTERS / FULL TIME)

### CURRICULUM

### SEMESTER I

| Sl No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | MAB6184 | Probability and Statistical Methods | 3 | 1 | 0 | 4 |
| 2. | CEB6101 | Research Methodology | 3 | 0 | 0 | 3 |
| 3. | CEB6121 | Modern Construction Materials | 3 | 0 | 0 | 3 |
| 4. | CEB6122 | Modern Construction Practices | 3 | 0 | 0 | 3 |
| 5. | CEB6123 | Construction Project Management | 3 | 0 | 0 | 3 |
| 6. | CEB6124 | Construction Planning Scheduling & Control | 3 | 0 | 0 | 3 |
| 7. | CEB6125 | Computational Laboratory I | 0 | 0 | 3 | 1 |
| 8. | CEB6126 | Seminar | 0 | 0 | 2 | 1 |
| | | | | | | **21** |

### SEMESTER II

| Sl No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CEB6231 | Project Appraisal and Risk Management | 3 | 0 | 0 | 3 |
| 2. | CEB6232 | Construction Quality & Safety Management | 3 | 0 | 0 | 3 |
| 3. | CEB6233 | Construction Equipment and Management | 3 | 0 | 0 | 3 |
| 4. | CEB6234 | Contract Laws and Regulations | 3 | 0 | 0 | 3 |
| 5. | | Elective I | 3 | 0 | 0 | 3 |
| 6. | | Elective II | 3 | 0 | 0 | 3 |
| 7. | CEB6235 | Computational Laboratory II | 0 | 0 | 3 | 1 |
| 8. | CEB6236 | Planning and Scheduling Project | 0 | 0 | 3 | 1 |
| | | | | | | **20** |

**SEMESTER III**

| Sl No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | | Elective III | 3 | 0 | 0 | 3 |
| 2. | | Elective IV | 3 | 0 | 0 | 3 |
| 3. | | Elective V | 3 | 0 | 0 | 3 |
| 4. | CEB7122 | Financial Accounting & Management | 3 | 0 | 0 | 3 |
| 5. | CEB7121 | Project Work - Phase I | 0 | 0 | 12 | 6* |
| | | | | | | **12** |

**SEMESTER IV**

| Sl No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CEB7121 | Project Work - Phase II | 0 | 0 | 36 | 18* |
| | | | | | | **18 + 6 = 24** |

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

**TOTAL CREDITS : 77**

## LIST OF ELECTIVES

| Sl No | Course Code | Course |
|---|---|---|
| 1. | CEBY51 | Construction Personnel Management |
| 2. | CEBY52 | Infrastructure Planning and Management |
| 3. | CEBY53 | Application of Information Technology in Infrastructure Management |
| 4. | CEBY54 | Urban Planning and Design |
| 5. | CEBY55 | Urban Transportation Planning |
| 6. | CEBY56 | Remote Sensing and GIS in Infrastructure Engineering |
| 7. | CEBY57 | Environmental Impact Assessment of Infrastructure Projects |
| 8. | CEBY58 | Financing and Management of Infrastructure Projects |
| 9. | CEBY59 | Total Quality Management |
| 10. | CEBY60 | Business Ethics for Construction Engineers |
| 11. | CEBY61 | Management Information System |
| 12. | CEBY62 | Intelligent Building Management System |
| 13. | CEBY63 | Green Building and Energy Efficient Structures |
| 14. | CEBY64 | Transportation Planning and Management |
| 15. | CEBY65 | Construction Resource Management |
| 16. | CEBY66 | Energy Auditing, Efficiency & Conservation |
| 17. | CEBY67 | Principles of Sustainable Development |
| 18. | CEBY68 | Quantitative Techniques in Management |
| 19. | CEBY69 | Urban Water Resources Management |
| 20. | CEBY70 | GIS Modeling In Urban and Regional Planning |
| 21. | CEBY71 | Renewable Energy Sources |
| 22. | CEBY72 | Industrial Waste Water Treatment |
| 23. | CEBY73 | Irrigation Water Quality and Modeling |
| 24. | CEBY74 | Principles of Biological Wastewater Treatment |
| 25. | CEBY75 | Sustainable and Green Building Design |
| 26. | CEBY76 | Performance Evaluation of Buildings |
| 27. | CEBY77 | Remote Sensing In Forestry |
| 28. | CEBY78 | Radar Image Processing |
| 29. | CEBY15 | Maintenance and Rehabilitation of Structures |
| 30. | MAB 682 | Optimization Techniques |
| 31. | SSB7181 | Society, Technology and Sustainability |

## SEMESTER I

**MAB6184 PROBABILITY AND STATISTICAL METHODS**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**OBJECTIVE:**

- This course intends to provide a comprehensive introduction to the probability distributions and statistical methods used in engineering.

**MODULE I PROBABILITY AND DISTRIBUTIONS 8**

Probability: concepts - probability laws - Baye's theorem, Frequency distribution -measures of central tendency and dispersion, Probability distributions: continuous - normal - log normal - Weibull - Gamma - Exponential, discrete distributions - Binomial - Poisson.

**MODULE II SAMPLING AND DISTRIBUTION 8**

Sampling - different methods - sample error - confidence intervals, sampling distributions - Test of hypothesis - level of significance - one tail / two tail tests, students t distributions, $\chi^2$ distribution.

**MODULE III ANALYSIS OF VARIANCE 7**

ANOVA - one way - two way classifications – Latin Square design – 22 factorial design.

**MODULE IV DESIGN OF EXPERIMENTS 7**

Experimental factors – interaction of factors, Types of experimental designs - blocking design - factorial – fractional factorial, Taguchi's orthogonal approach.

**MODULE V REGRESSION, CORRELATION AND CURVE FITTING 7**

Regression analysis - simple linear regression - regression coefficient, multiple regression -multiple & partial correlation coefficient, curve fitting - graphical - least square - method testing of goodness of fit.

**MODULE VI SIMULATION 8**

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

**L – 45; T – 15; Total Hours: 60**

## REFERENCES:

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' Pearson Editions 6th ed. India, 2002.
3. Jerry Banks, John S. Carson, Barry L. Nelson, Discrete – Event systems Simulation, Prentice Hall India, New Delhi, 1999.
4. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, Duxbury publication, 2007.
5. R. Lyman Ott, Michael Longnecker, 'An Introduction to Statistical Methods and Data Analysis', 6th edition, Brooks/Cole Cengage Learning, USA, 2010.
6. Sheldon M. Ross, Introduction to probability models, 10th edition, Academic Press, 2009.

## OUTCOMES:

At the end of the course students will be able to

- Identify and fit probability distribution for a given data.
- Analyze samples and make decisions.
- Solve problems in modeling using simulation techniques.

**CEB6101 RESEARCH METHODOLOGY L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To enable the students to understand the basics of scientific research, broaden their conception of what research involves.

**MODULE I RESEARCH PROBLEM FORMULATION 8**

Research – objectives – types – Research Process, Solving civil engineering problems, Identification of research topic, Formulation of research problem, Literature Survey and Review.

**MODULE II RESEARCH DESIGN 10**

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 USE OF STATISTICAL TOOLS IN RESEARCH 10**

Importance of statistics in research – concept of probability – popular distributions, sample design. Hypothesis testing, ANOVA, Design of experiments – factorial designs – orthogonal arrays, Multivariate analysis – curve fitting, Correlation and regression.

**MODULE IV ANALYSIS AND INTERPRETATION OF DATA 9**

Research Data analysis – interpretation of results – correlation with scientific facts, accuracy and precision – error analysis, limitations Use of Optimization Techniques – traditional methods – evolutionary optimization techniques – GA – PSO.

**MODULE V THE RESEARCH REPORT 8**

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: 45**

**TEXT BOOKS:**

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Kothari C.K., 2/e, Research Methodology- Methods and Techniques, New Age International, New Delhi, 2004.
3. Krishnaswamy, K.N., Sivakumar, Appa Iyer and Mathiranjan M. , Management Research Methodology; Integration of Principles, Methods and Techniques, Pearson Education, New Delhi, 2006.

**REFERENCES:**

1. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, 2006.
2. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi, 2010.
3. Blum, Deborah and Mary Knudson, eds., A field guide for science writers: the official guide of the National Association of Science Writers. New York: Oxford University Press, 1997.
4. Booth, Wayne, Gregory G Colomb, Joseph M. Williams. The craft of Research. Chicago: University of Chicago Press, 1995.

**OUTCOMES:**

At the end of this course, students will be

- able to do quality research and publish papers in reputed journals.
- able to formulate a research problem and use proper statistical tools to analyze and interpret the data and write a quality research report

**CEB6121 MODERN CONSTRUCTION MATERIALS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To impart knowledge regarding modern material and their suitability of applications in construction industry.

**MODULE I SPECIAL CONCRETES** **9**

High Strength and High Performance Concrete – Fibre Reinforced Concrete, Self compacting concrete - polymer concrete- Ready mixed concrete - Light weight concrete- Geopolymer concrete - Bacterial concrete - Polymer concrete - Vaccum concrete - concrete using mineral and chemical admixture- Alternate Materials to concrete.

**MODULE II METALS** **9**

Steel - New Alloy Steels – High Strength Low Alloy Steel - Aluminum and its Products –Applications in construction-Advantages and Disadvantages.

**MODULE III COMPOSITES** **9**

Plastics-Types- Properties - Application in construction - Reinforced Polymers-FRP -Types – Glass – Carbon - Aramid - Boron- Advantages & disadvantages-Applications - Cellular cores-Types - Uses in construction.

**MODULE IV OTHER MATERIALS** **9**

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 V 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 - Photovoltaic's - Phase Changing Materials – Others – Applications.

**Total Hours: 45**

## REFERENCES:

1. Shan Somayaji, Civil Engineering Materials , 2nd Edititon, Prentice Hall Inc., 2001.
2. Mamlouk, M.S. and Zaniewski J.P, Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
3. Derucher, K.Korfiatis. G. and Ezeldin, S., Materials for Civil and Highway Engineers , 4th Edition, Prentice Hall Inc., 1999.
4. Aitkens, High Performance Concrete , McGraw Hill, 1999.

## OUTCOMES:

At the end of the course the student will

- gain knowledge about various construction materials
- be able to choose the materials based on the applications.

**CEB6122 MODERN CONSTRUCTION PRACTICES**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To impart knowledge on modern construction practices related to sub structure, super structure and prefabricated construction.

**MODULE I SUBSTRUCTURE CONSTRUCTION** **9**

Box jacking - pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - cable anchoring and grouting Methods - large reservoir construction - stand by plant equipment for underground open excavation. Tunnel-Shaft sinking, Tunnel driving in hard and soft strata, bedding of conduits. Under water construction – Problems, encountered. Underwater drilling, blasting, and concreting - Dewatering of shallow and deep open excavations.

**MODULE II PILING TECHNIQUES** **9**

Piling – Behavior of single pile and a group piles during driving, under loads-ultimate loads on driven and cast in Situ piles. Construction details of precast piles, prestressed piles, and steel piles, friction piles, Driven and bored piles, large diameter piles, negative and positive skin friction, multiple under reamed piles, raker piles, sand piles, Anchor piles, load on piles – Static. Vibrating loads, cyclic loading, safe bearing load, Methods of pile driving by vibration above and under water through different strata, micro piles.

**MODULE III CAISSON AND COFFERDAM** **9**

Cofferdams – types, design and construction of single, double wall. Cofferdam. Sheet pile cofferdams, concrete wall movable cofferdam, land cofferdams, soldier construction method. Cofferdam wall by ICOS method, caissons, details, design and construction.

**MODULE IV 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.

## MODULE V SUPERSTRUCTURE CONSTRUCTION 9

Formwork& scaffolding – Slip form construction; 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.

**Total Hours: 45**

## REFERENCES:

1 Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, 8th Edition, McGraw Hill, Singapore, 2010.

2 Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.

3 Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 1997.

## OUTCOME:

- At the end of the course, the student will be able to choose and implement the modern construction techniques and practices related to sub structure, super structure and prefabricated construction.

**CEB6123 CONSTRUCTION PROJECT MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To impart knowledge on

- project life cycle
- organization for project management
- utilization of labour
- material and equipment
- cost estimation

**MODULE I THE OWNER'S PERSPECTIVE** **9**

Introduction-The project life cycle-Major Types of Construction-Selection of Professional Services-Construction contractors-Financing of constructed facilities-Legal and regulatory Requirements-The changing Environment of the construction Industry-The Role Project Managers.

**MODULE II ORGANIZING FOR PROJECT MANAGEMENT** **9**

Project management-Trends in Modern Management-Strategic planning and project programming- Effects of project risks on organization-Organization of Project Participants-Traditional designer-Constructor sequence-Professional construction management-Owner-Builder-Operation-Turnkey operation-Leadership and Motivation for the Project team-Interpersonal behavior in project organization-perceptions of Owners and Contractors

**MODULE III THE DESIGN AND CONSTRUCTION PROCESS** **9**

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

**MODULE IV LABOUR,MATERIAL AND EQUIPMENT UTILIZATION 9**

Historical Perspective-Labour Productivity-Factors Affecting Job-Site Productivity-Labor Relations in construction-Problems in collective bargaining-Materials Management-Materials Procurement and Delivery- Inventory control-Tradeoffs of cost in Material Management-Construction Equipment-Choice of Equipment and Standard production Rates-Construction Processes Queues and Resource Bottlenecks.

**MODULE V COST ESTIMATION 9**

Costs Associated with Construction Facilities-Approaches to cost estimation-Type of construction cost estimates-Effects of scale on construction cost-Unit cost-Method of estimation-Methods for allocation of joint costs-Historical cost data-Cost indices-Applications of cost Indices to Estimating-Estimate based on Engineers List of Quantities-Allocation of Construction costs over time-Computer Aided cost Estimation-Estimation of operating costs.

**Total Hours : 45**

**REFERENCES:**

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

**OUTCOME:**

- Upon completion of the course, students will be able to utilize the resources effectively and apply the principles of project management.

**CEB6124 CONSTRUCTION PLANNING SCHEDULING AND CONTROL** **L T P C 3 0 0 3**

**OBJECTIVE:**

To impart knowledge about

- planning construction projects
- scheduling the activities using network diagrams
- determining the cost of the project
- controlling the cost of the project by creating cash flows and budgeting
- using the project information as an information and decision making tool

**MODULE I CONSTRUCTION PLANNING** **8**

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method – Project Planning – Functions of Planning – Objectives and Policies- Defining Work Tasks- Work break down structure – Hierarchy of plan - Coding Systems – Project Control – variance analysis approach- performance analysis – Human aspects of project Management – Pre – requisites for successful project Implementation.

**MODULE II SCHEDULING TECHNIQUES** **10**

Development of Project Network - AOA and AON diagrams - Defining Precedence Relationships among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities -. - Critical Path Method – PERT- Construction Schedules – Scheduling Calculations - Float - Presenting Project Schedules - Scheduling for Activity-on-Node and with Leads, Lags, and Windows - Scheduling with Resource Constraints

**MODULE III SCHEDULING WITH UNCERTAIN DURATION** **9**

Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Improving the Scheduling Process.- Resources, Leveling Resources, Resource Leveling Strategies.

**MODULE IV COST CONTROL, MONITORING AND ACCOUNTING** **9**

The Cost Control Problem - The Project Budget - Forecasting for Activity Cost

Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

**MODULE V ORGANIZATION AND USE OF PROJECT INFORMATION 9**

Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow.

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

Upon the completion of the course students will be able to

- apply the general principles of project management
- manage the resources in a project effectively

| CEB6125 | COMPUTATIONAL LABORATORY - I | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1 |

**OBJECTIVES:**

To impart knowledge about

- process of planning
- scheduling and estimation of various construction projects using softwares

**MODULE I PLANNING AND SCHEDULING 15**

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

**MODULE II RESOURCE ALLOCATION, LEVELING AND REPORT PREPARATION 15**

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

**MODULE III ESTIMATION AND COSTING 15**

Estimation of a building based on the given plan – Estimation based on materials– dimensions – assigning of rates and values – analysis tool – total estimate – detailed estimate- report preparation

**Total Hours: 45**

**REFERENCES:**

1. Carl Chatfield, Timothy Johnson. D, Microsoft Project 2013 Step by Step, Microsoft press, Washington, 2013.

**OUTCOME:**

- At the end of the course, student will be able to perform planning, scheduling and estimation of various construction projects using software.

## SEMESTER II

**CEB6231 PROJECT APPRAISAL AND RISK MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To impart the knowledge on formulation, planning, appraising, financing and risk management in construction projects.

**MODULE I PROJECT FORMULATION** **9**

Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required

**MODULE II PROJECT COSTING & APPRAISAL** **9**

Project Cash Flows – Time Value of Money – Cost of Capital - NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal.

**MODULE III INFRASTRUCTURE FINANCING** **9**

Infrastructure Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios - Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.

**MODULE IV INTRODUCTION TO RISK MANAGEMENT** **9**

Principles of Risk Management - The hazard and risk –managing risk in the public and private sectors – Risk estimation – types of risk and classifications - Risk Management Documentation Risk Culture - Risk Identification – life cycle risk management – multi dimensional analysis – risk ranking – event incident scenario – Uncertainties and consequences – risk estimation – assessment – quantitative techniques –human factors – decision making under uncertainty.

**MODULE V RISK MITIGATION** **9**

Risk Mitigation- Transfer and Sharing of Risk - Elimination and Retention of Risk -Entrepreneurial risks - Pure risks - Internal risks Retaining insurable risks – Insurance -Self-insurance - Contractual Transfer of Risk – Captives - Responsibilities of Those Involved in Risk Transfer -- Factors Affecting Insurance as a Financing Tool - Internal Audit Function - Control Systems - Auditing Risk Management - Setting up an Internal Audit Function.

**Total Hours: 45**

**REFERENCES:**

1. Prasanna Chandra, Projects-Planning, Analysis ,Selection, Implementation Review, Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.

2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992

**OUTCOMES:**

At the end of the course student will be able to

- formulate and appraise the project
- perform risk analysis and implement mitigation strategies.

| CEB6232 | CONSTRUCTION QUALITY & SAFETY MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To impart knowledge in

- quality planning, assurance and improvement techniques.
- safety aspects involved 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. Quality system standard – ISO 9000 family of standards – 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 - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication-Regularity agent, owner, design, contract and construction oriented objectives, methods - Techniques and needs of QA/QC - Different aspects of quality - Appraisals, Factors influencing construction quality - Critical, major failure aspects and failure mode analysis -Stability methods and tools, optimum design - Reliability testing, reliability coefficient and reliability prediction.

**MODULE III QUALITY CONTROL AND IMPROVEMENT TECHNIQUES 9**

Quality improvement - Selection of new materials - Influence of drawings, detailing, specification, standardization - Bid preparation - Construction activity, environmental safety, social and environmental factors - Natural causes and speed of construction - Life cycle costing - Value engineering and value analysis - Quality checklist in sites - principles governing site lay out, factors effecting site lay out- preparation of site lay out. - Supervisor's responsibilities; keeping records; control of field activities handling disputes and work stoppages - storage

and protection of construction materials and equipment - testing and quality control- Purpose of inspection: Inspection of various components of construction; reports and records; statistical quality control.

**MODULE IV CONSTRUCTION ACCIDENTS &SAFETY PROGRAMMES 9**

Accidents and their Causes – Human Factors in Construction Safety - Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications-OSHA regulations for safety - Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives

**MODULE V CONTRACTUAL OBLIGATIONS &SAFETY DESIGN 9**

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping – contractual safety obligations – legal consequences of accidents Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation- Case study for Designers Outlook-Designing for Prevention Of Accidents-Formulation of Site Safety Regulations.

**Total Hours: 45**

**REFERENCES:**

1. James, J.o' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 1993.
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 2000.
5. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
6. John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, New York, 1989.

7. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.

8. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.

**OUTCOME:**

- At the end of the course, students will be able to implement the quality standards and techniques and ensure the safety measures in a project.

| CEB6233 | CONSTRUCTION EQUIPMENT AND MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To impart knowledge about various equipments used in construction Industry and managing the usage of equipments.

**MODULE I CONSTRUCTION EQUIPMENT MANAGEMENT 12**

Identification- Planning - Equipment management in projects - Maintenance management - Replacement-Cost control of equipment-Depreciation Analysis-Safety Management.

**MODULE II EARTH WORK EQUIPMENTS 8**

Fundamentals of earthwork operations-Earth moving operations-Types of Earthwork Equipment-Tractors, Motor Graders, Scrapers, Front end waders, Earth Movers.

**MODULE III OTHER CONSTRUCTION EQUIPMENTS 9**

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 IV MATERIALS HANDLING EQUIPMENT 8**

Forklifts and Related Equipment-Portable Material Bins-Conveyors-cranes Hauling Equipments and methods.

**MODULE V EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETING 8**

Crushers- Feeders - Screening Equipment - Handling Equipment – Batching and Mixing Equipment- Hauling, Pouring and Pumping Equipment-Transporters and related methods.

**Total Hours: 45**

**REFERENCES:**

1. Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., Construction Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore, 1995.

2. Sharma S.C., Construction Equipment and Management, Khanna Publishers New Delhi, 1988.

3. Deodhar, S.V., Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.

4. Dr. Mahesh Varma, Construction Equipment and its Planning and Application, Metro-politan Book Company, New Delhi, 1983.

**OUTCOME:**

At the end of the course, students will

- have the ability to identify suitable equipments according to the and construction work.
- be able to manage equipments use in project work

**CEB6234 CONTRACT LAWS AND REGULATIONS L T P C**
**3 0 0 3**

**OBJECTIVE:**

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

**MODULE I CONSTRUCTION CONTRACTS 9**

Indian Contracts Act – Elements of Contracts – Types of Contracts – Public Private Partnership in contract - Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts – Fatigue contract.

**MODULE II TENDERS 9**

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.

**MODULE III ARBITRATION 9**

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs.

**MODULE IV LEGAL REQUIREMENTS 9**

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Benefits in public private partnership -Local Government Laws for Approval – Statutory Regulations.

**MODULE V LABOUR REGULATIONS 9**

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations

– Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws

**Total Hours: 45**

**REFERENCES:**

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze,Construction Contracts, McGraw Hill, 2001.
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
4. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.
5. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press Private Limited, India, 2006.

**OUTCOME:**

- At the end of the course the students will be able to implement various laws and regulations related to contracts, arbitration, labor welfare and tenders in construction industry.

| CEB6235 | COMPUTATIONAL LABORATORY II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1 |

**OBJECTIVES:**

The objective of the course is to impart knowledge on

- key features of planning scheduling and controlling of a project.
- BIM as a tool for construction management using software.

**MODULE I PLANNING & SCHEDULING USING PRIMAVERA 15**

Planning & Scheduling of Multi storied building - Planning & Scheduling of Road construction project.

**MODULE II LEVELLING AND RESOURCE ALLOCATION 15**

Prepare the resource sheet, assign &level the resource - Preparing different reports available in Primavera - Plot the variance graphs for the given project

**MODULE III BUILDING INFORMATION MODELING 15**

Introduction to BIM CAD for windows-2D modeling-3D modeling-Architectural rendering-Desktop publishing- Document management- BIM using archi CAD 16

**Total Hours: 45**

**REFERENCE:**

1. Paul Eastwood Harris, Planning and Scheduling Using Primavera, Version 5.0 – For Engineering & Construction, Eastwood Harris Private Ltd, 2012.

**OUTCOMES:**

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

- create a project module,
- create a work breakdown sturucture,
- configure activity details,
- schedule a project
- update project status
- Use BIM for Construction management

| CEB6236 | PLANNING AND SCHEDULING PROJECT | L | T | P | C |
|---|---|---|---|---|---|
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**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 structural engineering.
- Students, working in groups of two, must identify a construction project, list the activities, establish an activity logic sequence table, estimate the duration, prepare a network diagram, track, update and crash the project.
- The Students are expected to implement the same plan using Project Management softwares.
- The teacher act as facilitator in helping students to acquire the technical knowledge and basic proficiency needed to perform the master plan.

## SEMESTER III

**CEB7122 FINANCIAL ACCOUNTING & MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To convey sufficient knowledge for an adequate interpretation, analysis and use the information provided by financial accounting.

**MODULE I INTRODUCTION TO ACCOUNTING** **8**

Introduction to Accounting - meaning of accounting, branches of accounting, objective of accounting - fundamental concepts - principals and rules of accounting, double entry book keeping - classification of accounts.

**MODULE II BASIC ACCOUNTING** **9**

Basic accounting cycles -Journal, ledger and trial balance sheet Financial statements Characteristics-Limitations-Financial Statement analysis. Ratio Analysis

**MODULE III CASH FLOW** **10**

Cash flow statement, Meaning and concepts of fund flow & cash flow, Difference between fund flow statement and income statement. Preparation and Interpretation of Fund Flow & Cash flow Statement.

**MODULE IV BUDGETING** **9**

Budgetary Control, Types of budgets-Techniques for Budgeting -Cash Budget-Functional Budgets-Flexible Budgets-Preparation and Interpretation.

**MODULE V COST ACCOUNTING** **9**

Cost accounting, Meaning and objective, Classification, Elements of cost Accounting, Elements of costs, Preparation of cost sheet, Allocation and absorption of overheads Direct cost - Overheads - Cost sheet .Standard Costing and Variance Analysis - Marginal Costing Cost - Volume Profit Analysis-Breakeven point. Application of Marginal costing techniques to managerial decision making.

**Total Hours: 45**

## REFERENCES:


1. Ramachandran N. Kalani Kumar ram, Financial Accounting for Management, Tata Mc Graw Hill, 2006.
2. Robert N. Anthony david F. Hawkins Kenneth A. Merchant, Accounting Text and Cases, Tata Mc Graw Hill, 2007.
3. Collis, Business Accounting, Palgrave Macmillan, 2007.
4. Ashok Banerjee, Financial- Accounting for Management, Vikas publishing, 2006.
5. Maheswari.S.N, S.K. Maheswari, Accounting for Management, Vikas publishing, 2006.
6. Bhattacharyya john Dearden S.K., Costing for Management, Vikas publishing, 2002.
7. Khan My Jain P.K, Management Accounting: Text, Problems and Cases, 4th Edition, Tata MCGraw Hill , 2007
8. Kothari RajeshGodha Abishek, Management Accounting: concepts and Application, Macmillan India Ltd, 2006.
9. Anthony N. Robert et.al, Accounting Text and Cases, 12th edition, Tata MCGraw Hill, 2007.
10. Tulsian P.C. Fundamentals of Accounting for CA Common Proficiency Test (CPT) Tata McGraw Hill, 2005.
11. Prasanna Chandra, Fundamentals of Financial Management 4th Edition, Tata McGraw Hill, 2007.
12. Ronald W. Hiltion, Managerial accounting , Tata MCGraw Hill, 2005.
13. Jan R. Williams Susan F.Haka Mark S. Bettner, Financial & Managerial Accounting The Basis for Business Decisions, Tata McGraw Hill, 2005.
14. Jain & Narang, Cost Accounting, Kalyani Publisher, 2005.
15. Banerjee, Cost Accounting, PHI, 2006.
16. Nigam & Jain, Cost Accounting, PHI, 2006.

**OUTCOMES:**

On completion of the course students will

- be able to understand fundamental concepts of financial accounting and management,
- gain knowledge on all the components of the balance sheet, using a double entry book keeping perspective.
- able to analyze a company's financial statements and come to a reasoned conclusion about the financial situation of the company.

## ELECTIVES

**CEBY51 CONSTRUCTION PERSONNEL MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

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

**MODULE I MANPOWER PLANNING** **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** **10**

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

**MODULE IV WELFARE MEASURES** **7**

Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.

**MODULE V MANAGEMENT AND DEVELOPMENT METHODS** **10**

Compensation - Wages and Salary, Employee Benefits, employee appraisal and assessment - Employee services - Safety and Health – Discipline and discharge - Special Human resource problems, Performance appraisal - Employee hand book and personnel manual - Job descriptions and organization structure and human relations – Productivity of Human resources.

**Total Hours: 45**

## REFERENCES:

1. Carleton Counter II, Jill Justice Coutler, The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989.
2. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.
3. Josy.J. Familaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1987.
4. Dwivedi R.S, Human Relations and Organizational Behavior, Macmillan India Ltd., 2005.

## OUTCOME:

- At the end of the course, students will be able to implement the sound personnel policies of employee morale, employee efficiency and organizational goals.

**CEBY52 INFRASTRUCTURE PLANNING AND MANAGEMENT** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

To impart knowledge on

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

**MODULE I BASIC CONCEPTS RELATED TO INFRASTRUCTURE. 9**

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 9**

A Historical Overview of Infrastructure Privatization. - The Benefits -Problems with Infrastructure Privatization - pre – requisites necessary to ensure success for switching over from public sector management to private sector management, issues in developing, funding and managing infrastructure projects, role, and responsibility of project management consultants. Challenges in Privatization of Water Supply - Case Study - Challenges in Privatization of Power - Privatization of Road Transportation Infrastructure in India.

**MODULE III CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION 9**

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 9**

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 9**

Information Technology and Systems for Successful Infrastructure Management - Innovative Design and Maintenance of Infrastructure Facilities- Infrastructure Modelling and Life Cycle Analysis Techniques - Capacity Building and Improving the Governments Role in Infrastructure Implementation - An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

At the end of the course the students will have knowledge about

- various types of infrastructure development
- risk management strategies
- cost benefit analysis
- planning principles
- role of public and private participation in infrastructure management

**CEBY53 APPLICATION OF INFORMATION TECHNOLOGY IN INFRASTRUCTURE MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To impart knowledge on estimation, planning and scheduling softwares and applications such as spread sheets etc.

**MODULE I INTRODUCTION** **9**

Introduction to System Hardware – Languages – Feasibility study and analysis – procurement, training, implementation and system management – procedural Language - developing application with spread sheet -developing application with files and database software.

**MODULE II BUILDING INFORMATION MODELING SOFTWARE** **9**

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

**MODULE III PLANNING AND SCHEDULING** **9**

PERT and CPM - Advanced planning and scheduling concepts – Risk Management -Computer Applications – case study.

**MODULE IV ESTIMATION AND FINANCING** **9**

Estimating – project planning and scheduling- accounting and cost engineering – Enterprises – Introduction to ERP systems - operations simulation Financial Management- For use of tracking and developing the cost reports and issuing the change orders. Computer applications – case study.

**MODULE V OPTIMIZATION TECHNIQUES** **9**

Optimization Techniques - Linear, Dynamic and Integer Programming-Branch and Bound Techniques-Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems - Deterministic and Probabilistic Inventory Models-Software Development.

**Total Hours : 45**

## REFERENCES:

1. Bily E. Gillet., Introduction to Operation Research - A Computer Oriented Algorithmic Approach, Tata McGraw Hill, 1990.Inc., 1999.

2. Paulson, B.R., Computer Applications in Construction, McGraw Hill, 1995.

## OUTCOME:

- At the end of the course the student will be able to perform estimation, planning and Scheduling for construction project using software.

**CEBY54 URBAN PLANNING AND DESIGN L T P C**
**3 0 0 3**

**OBJECTIVE:**

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

**MODULE I INTRODUCTION 9**

Definition of Terms – Human Settlement, Town/City, Region, City Region, Urbanization, Suburbanization, Urban Sprawl, Urban Fringe, Central Business District (CBD), Trend of Urbanization at International, National, State and District levels .National and Regional Development Policies and Strategies – Urbanization, Housing and Transportation Sustainable Urban Development-Definition and Principles.

**MODULE II PLANNING PROCESS 9**

Types of Urban and Regional Plans, Stages in the Planning Process – Delineation of Planning Areas, Goals and Objectives of Plans, Surveys and Analysis, Formulation of Plans, Evaluation of Alternative Plans, Plan Implementation, Legal, Financial and Institutional Constraints in the Planning Process .Social Orientation in the Planning Process.

**MODULE III DEVELOPMENT MANAGEMENT SYSTEMS 9**

Development Control Rules – Zoning Regulations, Sub Divisional Regulations, Building Bye-laws, Co-ordination between Urban Local Bodies and Other Functional Agencies such as Water supply & Sewerage Boards, Housing Boards including Slum Boards and Planning Authorities

**MODULE IV ARCHITECTURAL DESIGN 9**

Architectural design – principle of architecture – factors that determine climate – various design for climate – principle of landscape design

**MODULE V MANAGEMENT INFORMATION AND DECISION SUPPORT 9**

Database, Management information system, Decision Support system for Land Suitability, Urban Renewal and Network Analysis.

**Total Hours: 45**

**TEXT BOOKS:**

1. Gallian B Arthur, Simon Eisner, The Urban Pattern, City Planning and Design, Affiliated Press Pvt. Ltd., New Delhi, 1995.

2. Margaret Roberts, An Introduction to Town Planning and Planning Techniques, Hutchinson, London, 1990.

**REFERENCES:**

1. Master Plans for Cities and Towns prepared by Planning Authorities, Chennai Metropolitan Development Authority, 1995.

2. Development Control Rules for Chennai Metropolitan Area, CMDA, Chennai, 2002.

3. Rangwala S C, Town Planning, Charotar Publishing House, 1987.

4. Francis D.K.Ching Architecture: Forms, space and order , VNR, New York,1999.

**OUTCOME:**

- At the end of the course the student will be able to perform urban planning and design as per zoning rules and regulation and architectural design.

**CEBY55 URBAN TRANSPORTATION PLANNING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To impart knowledge on various issues involved in

- urban planning
- urban region and environment
- urban built-in environment

**MODULE I URBAN PLANNING AND ENVIRONMENT** **9**

Environment and Resources, Sustainability Assessment, Future Scenarios, Shape of Urban Region, Managing the change, Integrated Planning, Sustainable Development

**MODULE II URBAN REGION AND ENVIRONMENT.** **9**

City Centre, Development Areas, Inner City Areas, Suburban Areas, Peri urban and Country side, Economy and Society.

**MODULE III THE URBAN BUILT – IN ENVIRONMENT** **9**

Urban Form, Land Use, Compact Development, Transport Integrated Urban Planning, Housing and Household, services and Industry, Guidelines for Environmentally sound Transportation.

**MODULE IV BASIC APPLICATIONS IN TRANSPORTATION** **9**

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

**MODULE V ADVANCED APPLICATIONS** **9**

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

**Total Hours : 45**

## REFERENCES:

1. George Godwin; Traffic, Transportation and Urban Planning, Pitmen Press, Great Britain , 1981.
2. Sustainable Transportation and TDM – Planning the balances, Economic, Social and Ecological objectives, Victoria Transport Policy Institute, 2007.
3. Burrough P, A. Principles of GIS for Land Resources Assessment, Oxford Publication , 1994.
4. Jeffrey Star and John Ester, Geographical Information System – An Introduction, Prentice Hall Inc., Englewood Cliffe, 1990.
5. Marble, D.F, Calkins H.W, and Penquest, Basic Reading in GIS, Speed Syste Ltd., New York, 1984.

## OUTCOMES:

Upon successful completion of the course, the student will get

- to know the various applications in transportation field and advanced applications involving GIS
- a deep insight for proper sustainable transportation planning, keeping in regards of urban region and environment.

**CEBY56 REMOTE SENSING AND GIS IN INFRASTRUCTURE** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

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

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

**OUTCOMES:**

At the end of the course the student will gain knowledge about

- the fundamentals of remote sensing and GIS and their data structures.
- application in transportation, water and environment management.

**CEBY57 ENVIRONMENTAL IMPACT ASSESSMENT OF INFRASTRUCTURE PROJECTS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To impart the knowledge about

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

**MODULE I INTRODUCTION** **6**

Environmental impact assessment (EIA), definitions and concepts, rationale and historical development of EIA, EIA in Civil Engineering, Initial environmental examination, Environmental appraisal, Environmental impact factors and areas of consideration, Measurement of environmental impact, Status of EIA in India, Types and Limitations of EIA

**MODULE II EIA: PROCESSES AND PROCEDURES** **10**

Components of EIA – Methods, Techniques & Procedure for EIA - Processes – Screening- Scoping- Setting- Analysis- Mitigation. Matrices- Networks – Checklists – Connections and combinations of processes - Cost benefit analysis – Analysis of alternatives – Expert systems in EIA - Environmental Impact Statement.

Technical Components of Environmental Impact Assessment - Case Studies -Water Resources, Water Quality, and Land Resources - Land Use, Ecology and Wetlands - Traffic and Transportation - Waste Management and Hazardous Materials.

**MODULE III SOCIO-ECONOMIC IMPACT ASSESSMENT** **9**

Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Socio-cultural environments -Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation.

**MODULE IV ENVIRONMENTAL MANAGEMENT 10**

Environmental management - principles, problems and strategies; Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes; Review of political, ecological and remedial actions; future strategies; multidisciplinary environmental strategies, the human, planning, decision-making and management dimensions; Environmental Planning and the Future of EIA - Ethical and Quality aspects of Environmental Impact Assessment.

**MODULE V ENVIRONMENTAL AUDIT, LIFE CYCLE ASSESSMENT & STANDARDIZATION 10**

Environmental audit - definitions and concepts, partial audit, compliance audit, Post project audit methodologies and regulations. Life cycle assessment; Triple bottom line approach; Industrial Ecology; Ecological foot printing; Carbon trading; Sustainable development; Introduction to ISO and ISO 14000; EMAS regulations; Wider application of system based approach.

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

Upon successful completion of this course, the student will be

- able to understand components and structure of an EIA
- able to appreciate specific methods and tools used in EIA and assesment principles
- able to apply methods and approaches used in EIA

| CEBY58 | FINANCING AND MANAGEMENT OF INFRASTRUCTURE PROJECTS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

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

**MODULE I INFRASTRUCTURE DEVELOPMENT - INTRODUCTION 9**

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

**MODULE II PUBLIC PRIVATE PARTNERSHIPS – PROCUREMENT PROCESS 9**

Introduction to infrastructure development through PPP route; Benefits of PPP mode of procurement; Types of PPP Models and their contractual structure; Stakeholders' perspectives; Granting authority, Funders and Concessionaire; Government's role in successful PPP projects; Appraisal of Projects; VFM evaluation; PPP procurement process; Lifecycle of PPP projects; Contractual package of PPP project; Bankable concession agreement - Case study

**MODULE III CONCESSION – DESIGN AND AWARD 9**

Introduction to concession design and award; Concession Design: Price setting; Price adjustment; Specific performance targets; Penalties and bonuses; Public parties' security rights; Duration, termination, and compensation; Force majeure and other unforeseen changes; Dispute settlement; Concession Award: Competitive bidding; Direct negotiations and unsolicited proposals; Competitive negotiations; Prequalification and unsolicited proposals; Competitive negotiations; Prequalification and short listing; Bid structure and evaluation; Bidding rules and procedures; Case Study

**MODULE IV RISK MANAGEMENT OF INFRASTRUCTURE PROJECTS 9**

Risks associated with various infrastructure projects; Introduction to risk management concept; Risk analysis techniques; Risk mitigation strategies; Risk allocation frameworks of major infrastructure projects procured through various PPP modes - Environmental Concerns and its Impact on Infrastructure development.

**MODULE V PROJECT FINANCE 9**

Introduction to project financing concept; Analysis of project viability; Designing security arrangements; Preparing the project financing plan; Introduction to credit rating of infrastructure projects and role of credit ratings in financing infrastructure projects; Rating frameworks of various national and international credit rating agencies for infrastructure projects in various sectors. Financing through International Capital Markets; Urban Infrastructure Financing.

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

Upon Completion of this course the learner will be able to

- Identify the need for Infrastructure development for the growth of a country, the scope and hurdles for Infrastructure development
- Identify the various means of financing an Infrastructure project
- Mobilize various resources to projects
- Deal with risk associated with Infrastructure financing

**CEBY59 TOTAL QUALITY MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVES:**

To impart students

- the knowledge on concepts, tools, standards,
- the systems for Quality Management in construction Industry.

**MODULE I INTRODUCTION 9**

Definition of Quality - Dimensions of Quality - Concept of Quality Control - Quality Assurance - Quality Planning - Quality costs - Analysis Techniques for Quality Costs - Basic concepts of Total Quality Management - Historical Review - Principles of TQM - Necessity for improving Quality in the context of Global Challenges - Barriers to TQM Implementation.

**MODULE II QUALITY IN CONSTRUCTION 10**

Study of various Quality Standards in Construction - Related to building materials and other inputs for construction processes - methods and techniques for construction outputs, - products and services, such as BIS, BS, Indian standard, British, American, German & Japanese standards - Managing Quality in various projects stages from concept to completion by building quality into design of structures - Inspection of incoming material and machinery - In process quality inspections and tests.

**MODULE III QUALITY CONTROL 9**

Statistical Quality Control - Introduction, c chart, p chart X Chart, Designing of quality manuals, checklists and inspection reports, installing the quality assurance system, monitoring and control.

**MODULE IV TQM TOOLS 9**

Developing quality culture in the organization - Training of people - Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality circles ,Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

**MODULE V QUALITY SYSTEMS** **8**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

**Total Hours: 45**

**REFERENCES:**

1. Dale H. Besterfiled, et al., Total Quality Management, Pearson Education Inc., 2003.
2. James R.Evans & William M.Lidsay, The Management and Control of Quality, 5th Edition, South-Western Thomson Learning, 2002.
4. Feigenbaum.A.V., Total Quality Management, McGraw Hill, 1991.
5. Oakland.J.S.Total Quality Management Butterworth – Hcinemann Ltd., Oxford, 1989.
6. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International,1996.
7. Zeiri, Total Quality Management for Engineers, Wood Head Publishers, 1991.

**OUTCOME:**

At the end of the course the student will be in a position to

- apply the total quality systems tools and techniques in construction organization

| CEBY60 | BUSINESS ETHICS FOR CONSTRUCTION ENGINEERS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To create awareness on business ethics in work place, human values, social responsibilities and customer rights

**MODULE I INTRODUCTION TO BUSINESS ETHICS** **9**

Introduction to business ethics-Definition-Roles in Various types of business structures-importance of ethics-Responsibilities and obligations-Structure of business ethics

**MODULE II ETHICS IN WORKPLACE** **9**

Definition- Small business ethics- Code of conduct- Code of ethics- Corporate responsibility- Corporate compliance-responsibilities-laws and regulations-Dress code-Smoking-Alcoholism and misbehaviour

**MODULE III SOCIAL RESPONSIBILITY** **9**

Business accountability-ethical values- Environmental awareness-Positive impact of ethics in business-Employee rights-Productivity-Legality issues

**MODULE IV CUSTOMER RIGHTS** **9**

Necessity of customer rights-Global competition-Corporate integrity-Expectation of customers Vs. reality-Business and Society-Financial world-insider trading-Junk bonds-Leveraged buyouts-Employee rights

**MODULE V HUMAN VALUES** **9**

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality-Ethics and Human values in major religions

**Total Hours: 45**

**TEXT BOOKS:**

1. Mike Martin and Roland Schinzinger, Ethics in engineering, McGraw-Hill, New York 1996.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles D. Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall, New Jersey, 2004.

2. Charles E Harris, Michael S. Protchard and Michael J Rabins, Engineering Ethics – Concepts and Cases, Wadsworth Thompson Learning, United States, 2000.

3. John R Boatright, Ethics and the Conduct of Business, Pearson Education, New Delhi, 2003.

4. Edmund G Seebauer and Robert L Barry, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.

**OUTCOMES:**

At the end of the course, the student will be

- able to recognise the impartant of business ethics and moral value in the society
- able to appreciate the social and moral responsibilities of a civil engineer in the society

**CEBY61 MANAGEMENT INFORMATION SYSTEM**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To lay emphasis on

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

**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**

## REFERENCES:

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

2. Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.

3. Joyce J Elam, Case series for Management Information Systems, Simon and Schuster, Custom Publishing, 1996.

4. Ralph H Sprague and Huge J Watson, Decision Support for Managers, Prentice Hall, 1996.

5. Michael W. Evans and John J Marciniah, Software Quality assurance and Management, John Wiley and Sons, 1987.

6 Card and Glass, Measuring Software Design quality, Prentice Hall, 1990.

## OUTCOME:

- Upon successful completion of the course, the students will be able to explain the procedures for successfully managing information systems in projects.

**CEBY62 INTELLIGENT BUILDING MANAGEMENT SYSTEM**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

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

**OUTCOME:**

Upon completion of the course, the student will be

- able to work in construction projects involving Intelligent Buildings Management Systems.
- can explore Building Management Systems encompassing enormous variety of technology and building controls.

| CEBY63 | GREEN BUILDING AND ENERGY EFFICIENT STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To impart the knowledge on

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

**MODULE I INTRODUCTION** **9**

Energy required for building construction - Heat Transfer – Measuring Conduction –Thermal Storage – Measurement of Radiation – The Green house Effect – Psychrometry Chart – Measuring latent and sensible heat. Thermal Comfort – Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Location Sun Protection – Types of Shading Devices – Conservation – Heating and cooling loads - IGPC's rating systems - sustainable sights - water efficiency - energy efficiency - Materials and resources - Indoor Environmental quality.

**MODULE II PASSIVE SOLAR HEATING AND COOLING** **9**

General Principles of passive Solar Heating – Key Design Elements - Direct gain Trombe Walls, Water Walls, Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Predicting ventilation in building-window ventilation calculations - Radiation – Evaporation and dehumidification–Mass Effect–Load Control – Air Filtration and odour removal – Heat Recovery in large buildings

**MODULE III DAYLIGHTING AND ELECTRICAL LIGHTING** **9**

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** **9**

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** **9**

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

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOME:**

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

- model different energy efficient systems and manage it by adopting appropriate design methodology.

**CEBY64 TRANSPORTATION PLANNING AND MANAGEMENT** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

To impart knowledge on

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

**MODULE I TRANSPORTATION SYSTEMS** **7**

Systems Approach to Transport Planning – Interdependence of the Land use and Traffic– Stages in Transportation Planning – Transport Planning Considerations Travel Forecasting Process – Statutory Land Use Planning Process – Planning Issues

**MODULE II TRANSPORTATION INVENTORIES & TRAVEL DEMAND FORECASTING** **11**

Concepts of Zoning – Methods of Transportation Surveys – Inventory of Transport and other activities – Planning Studies and Methods – Development of Planning Process Conventional Modeling Process – Four Stage Modeling Processes – Trip Generation Models – Trip Distribution Models and Calibration – Advancement in Trip End Modeling

**MODULE III ROUTE AND MODE CHOICE MODELING** **9**

Methods of Trip Assignment Models – Multi Modal Trip Assignment – Mode Choice and Modal Split Models – Advancement in Route Choice and Mode Choice Modeling

**MODULE IV LAND USE TRANSPORT MODEL (LUT)** **9**

Accessibility Measures and Basic Theories – Lowery Derivatives Model- Garim Model – Basics of Systems Approach in LUT Model- Classification of Land use Models – Intercity Travel Demand Models – Transit Planning and Services.

**MODULE V TRANSPORT MANAGEMENT** **9**

History of transport with special reference to road transport in India Modes of Road transport Organization- Service station and its functions, General layout

of modern service station, Spare parts section and dealership service section, Accounts and books, Different types of cards and their use in maintaining service station records Structure of fleet organization, management of fleet State transport - optimum utilization of fleet, theory of fares/freight Roadworthiness requirement, Maintenance of logbook, History sheet, Causes, and prevention of Road Accident, Analysis of Accident, Economy of replacement, Assessment of used vehicles for sale and purchase, Training of Drivers and Mechanics. Taxation – Structure and formalities relating to calculating and paying the relevant taxes.

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOME:**

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

- perform transportation planning, trip distribution models, route choice modeling and management.

**CEBY65 CONSTRUCTION RESOURCE MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To imparts knowledge on resource planning, allocation, levelling and time management.

**MODULE I RESOURCE PLANNING** **11**

Resource Planning, Procurement, Identification, Personal, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment Material, Money, Time

**MODULE II LABOUR AND EQUIPMENT MANAGEMENT**

Systems approach in resource management, Characteristics of resources, Resource Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule ,Optimum use Labour.

Equipment: Selection, planning and matching of construction plant and equipment with emphasis on site application, site layout, financing, hire-purchase options, owning and operation charges, economic replacement. Equipment management organization, repairs and maintenance.

**MODULE III TIME** **11**

Personal time, Management and planning, Managing time on the project, forecasting the future, Critical path measuring the changes and their effects. Cost control : Cash flow and cost control, objectives of cost, Time and quality

**MODULE IV MATERIAL MANAGEMENT** **11**

Importance, scope, objective and functions of material management. Integrated approach to materials management. Materials of construction: classification, codification, ABC analysis, standardization, substitution, variety reduction. Estimating of material requirement, phasing of their procurement. Procurement: identification of sources, vendor analysis, purchases procedure, legal aspects of purchasing, transporting of materials. Transportation modes. Inventory/Stock control: importance, models, EOQ. Store Management: Stores organization, stores layout, receipts and inspection, issue of materials. Care and safety in handling. Store records and store accounting.

## MODULE V RESOURCE ALLOCATION AND LEVELLING

Time-cost trade off, Computer application in resource levelling examples, resources list, resource allocation graph, Resource loading, Cumulative cost ETC-Value Management.

**Total Hours: 45**

## REFERENCES:

1. Andrew, Szilagg, Hand Book of Engineering Management, 1982.
2. Glenn, A Sea's and Reichard J Clough, Construction Project Management, John Wiley and Sons Inc., 1979.
3. Harvey, A.Levline, Project Management using Micro Computers, Obsome - McGraw Hill C.A. Publishing Co., Inc. 1988.
4. James A., Adrain, Quantitative Methods in Construction Management, American Elsevier Publishing Co., Inc., 1973.
5. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry, Granda Publishing Ltd., 1980.

## OUTCOME:

At the end of the course the student will be

- able to perform, resource planning, resource allocation, resource levelling, time management in the construcation projects.

| CEBY66 | ENERGY AUDITING, EFFICIENCY AND CONSERVATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- To impart students the knowledge on various sources of energy, energy conservation, energy efficient building design and energy management.

**MODULE I FUNDAMENTALS OF ENERGY CONSERVATION 9**

Fundamentals of energy-Energy Production Systems -Heating. Ventilating and Air. conditioning -Solar Energy and Conservation -Energy Economic Analysis -Energy conservation and audits -Domestic energy consumption -savings-challenges -primary energy use In buildings -Residential. Commercial -Institutional and public. Buildings

**MODULE II ENERGY AND RESOURCE CONSERVATION 9**

Energy and resource conservation. Design of green buildings -Evaluation tools for building energy -Embodied and operating energy .Peak demand-Comfort and indoor air quality -Visual and acoustical quality -Land, water and materials -Airborne emissions and waste management.

**MODULE III NATURAL BUILDING DESIGN CONSIDERATION 9**

Natural building design consideration. Energy efficient design strategies -Contextual factor -Longevity and process Assessment -Renewable Energy Sources and design -advanced building Technologies. Smart buildings -Economics and cost analysis

**MODULE IV ENERGY IN BUILDING DESIGN 9**

Energy in building design.- Energy efficient and environment friendly building -Thermal phenomena.-thermal comfort- Indoor Air quality -Climate, sun and Solar radiation. Psychometrics -passive heating and cooling systems- Energy Analysis. Active HVAC-systems -Preliminary Investigation -Goals and policies -Energy audit -Types of Energy audit -Analysis of results -Energy flow diagram -Energy consumption /Unit Production- identification of wastage -Priority of conservative measures -Maintenance of energy management programme.

**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 systems- Air conditioning systems- Applications- .Facility operation and maintenance-Facility modifications- Energy recovery dehumidifier- Waste heat recovery. Steam plants and distribution systems- Improvement of boiler efficiencies-Frequency of blow down -Steam leakage-steam Flash and condensation.

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOME:**

- At the end of the course, the students will be able to implement energy conservation design and techniques in construction of buildings.

**CEBY67 PRINCIPLES OF SUSTAINABLE DEVELOPMENT** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

To impart knowledge in

- concepts and dimensions of sustainable development
- framework for achieving sustainability

**MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT** **9**

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Green house 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** **9**

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** **9**

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** **9**

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 9**

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. Kirkby J. O keefe P. and Timberlake, Sustainable Development, Earth scan Publication London, 1993.
3. Mackenthun K,M., Concepts in Environmental Management, Lewis Publications London,1988.
4. Bowers J, Sustainability and Environmental Economics – An Alternative Text, Logman London, 1997.

**OUTCOMES:**

At the end of the course the student will have a wide knowledge on

- Concepts and dimensions of sustainable development
- Frame work for achieving sustainability

**CEBY68 QUANTITATIVE TECHNIQUES IN MANAGEMENT** **L T P C**
**3 1 0 4**

**OBJECTIVE:**

To impart knowledge on

- operations research
- production management
- financial management
- decision theory and managerial economics

**MODULE I OPERATIONS RESEARCH** **12**

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

**MODULE II PRODUCTION MANAGEMENT** **12**

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

**MODULE III FINANCIAL MANAGEMENT** **12**

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

**MODULE IV DECISION THEORY** **12**

Decision Theory-Decision Rules-Decision making under conditions of certainity, risk and uncertainity-Decision trees-Utility Theory.

**MODULE V MANAGERIAL ECONOMICS** **12**

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

**Total Hours: 60**

## REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 1990.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 1982.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 1988.
4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 1975.
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, production management, financial management, decision theory and managerial economics in construction management

**CEBY69 URBAN WATER RESOURCES MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart knowledge about modeling of urban water resources, storm water management, planning, operation and maintenance of urban water system.

**MODULE I URBAN HYDROLOGIC CYCLE** **9**

Water in the urban eco-system – Urban Water Resources – Major problems – Urban hydrological cycle – Storm water management - objectives and limitations – Storm water policies – Feasibility consideration.

**MODULE II URBAN WATER RESOURCES MANAGEMENT MODELS** **9**

Types of models – Physically based – conceptual or Unit hydrograph based – Urban surface runoff models – Management models for flow rate and volume control rate – Quality models.

**MODULE III URBAN STORM WATER MANAGEMENT** **9**

Storm water management practices ( Structural and non-structural management measures) – Detention and retention concepts – Modeling concept – Types of storage – Magnitude of storage – Hydraulic analysis and design guidelines – Flow and storage capacity of urban components – Temple tanks.

**MODULE IV MASTER PLANS** **9**

Planning and organizational aspects – Inter dependency of planning and implementation of goals and measures – Socio-economic financial aspects – Potential costs and benefit measures – Measures of urban drainage and flood control benefits – Effective urban water user organizations.

**MODULE V OPERATION AND MAINTENANCE** **9**

General approaches to operations and maintenance – Complexity of operations and need for diagnostic analysis – Operation and maintenance in urban water system – Maintenance Management System – Inventories and conditions assessment – Social awareness and involvement.

**Total Hours: 45**

## REFERENCES:

1. Geiger, W.F., Marsalek, F., and Zuidena, F.C., (Ed.), Manual on drainage in urbanized areas, Vol.1 and Vol.II, UNESCO, 1987.
2. Hengeveld, H. and C. De Voch.t (Ed.), Role of Water in Urban Ecology, Elsevier Science Ltd., U.K.,1982.
3. Martin, P. Wanelista and Yousef A. Yousef., Storm Water Management, John Wiley and sons, 1993.
4. Neil S. Grigg., Urban Water Infrastructure Planning, Management and Operations, John Wiley and Sons, 1986.
5. Overtens D.E. and Meadows M.E., Storm Water Modelling, Academic Press, New York, 1976.

## OUTCOMES :

- At the end of the course, the student will be able to involve and take part in real world projects to carry out modeling of urban water resources, storm water management, planning, operation and maintenance of urban water system.

| CEBY70 | GIS MODELING IN URBAN AND REGIONAL PLANNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart knowledge about urban and regional planning with hands on experience in GIS package to deal the urban and regional planning process.

**MODULE I INTRODUCTION** **9**

Classification of spatial and non-spatial data – Application of spatial data in urban and regional planning – Objectives and functions of GIS models in urban and regional planning.

**MODULE II SPATIAL DATA INPUT** **9**

Defining the objectives of GIS planning problems – Identification of required spatial data layers – Coding schemes – Digitization of spatial data – Editing spatial data usable for the given planning problem.

**MODULE III ATTRIBUTE DATA INPUT** **9**

Role of attribute data in defining geographic features – Adding attribute data file – Topology generation – Joining attribute data to its geographic features.

**MODULE IV SPATIAL ANALYSIS USING GIS** **9**

Performing overlay functions – Manipulating attribute data – GIS modeling – Map and report generation.

**MODULE V CASE STUDY** **9**

Case problems on regional analysis, impact assessment study, project formulation and land suitability analysis.

**Total Hours : 45**

**REFERENCES:**

1. Brail K.R., “Integrating GIS into Urban and Regional Planning - Alternative Approaches for Developing Countries Regional Development, Dialogue, Vol. 11, No.3, UNCRD, Japan, 1990.
2. Cartwright T.J., Information Systems for Urban and Management in Developing Countries - The concept and reality, Computers, environment and urban systems, Vol. 15, 1991.

3. Klosterman R.E., Microcomputer Packages for Planning Analysis, American Planning Association Journal, Autrenn, 1990.

4. ESRI, “Understanding GIS - The ARCINFO Methods”, ESRI, USA, 1992.

5. Tomlin C.D., Geographic Information Systems and Cartographic Modeling, Prentice Hall, Englewood Cliffs, U.S.A, 1990.

**OUTCOMES:**

- At the end of the course, students will be able to implement GIS and remote sensing techniques to solve problems related to urban and regional planning.

**CEBY71 RENEWABLE ENERGY SOURCES L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To impart knowledge about different types of renewable energy such as solar energy, wind, geothermal energy , hydro energy, tidal and bio energy and their characteristics including applications.

**MODULE I ENERGY AND ENVIORNMENT 9**

Primary energy sources - World energy resources- Indian energy scenario – Energy cycle of the earth – Environmental aspects of energy utilization, CO2 emissions and Global warming, global dimming – Clean Development Mechanism(CDM)- Renewable energy resources and their importance - Potential impacts of harnessing the different renewable energy resources.\

**MODULE II SOLAR ENERGY 9**

Extraterrestrial solar radiation - Radiation at ground level-collectors - Solar thermal applications – Water heaters and air heaters – performance and applications – simple calculations – Solar cooling – Solar drying – Solar ponds – Solar tower concepts – Solar furnace- Solar photovoltaic (SPV) - Building Integrated photovoltaic.

**MODULE III WIND, GEO THERMAL AND HYDRO ENERGY SOURCES 9**

Energy from wind-basic theory- Types of wind turbines-applications - Geothermal Energy-geothermal resource types-resource base-applications for heating and electricity generation - Hydropower-introduction-basic concepts for site selection- Turbines for small scale hydropower generation.

**MODULE IV TIDAL & BIO ENERGY 9**

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 OTHER RENEWABLE ENERGY SOURCES 9**

Open and Closed OTEC cycles - Ocean Currents - Salinity Gradient Devices - Bio photolysis - Potential impacts of harnessing the different renewable energy resources - Hybrid systems.

**Total Hours : 45**

## REFERENCES:

1. G.N. Tiwary, Fundamentals of Renewable Energy Sources, Narosa publishers, New Delhi, 2006.
2. A. Duffie and W.A.Beckmann, Solar Engineering of Thermal Processes, John wiley, 1980.
3. F. Kreith and J.F. Kreider, Principles of Solar Engineering, McGraw-Hill ,1978.
4. T.N. Veziroglu, Alternative Energy Sources, Vol. 5 and 6, McGraw-Hill,1978.
5 G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 2009.

## OUTCOMES:

- At the end of the course, the student will be able to choose and incorporate suitable alternative energy resources based on the project requirement to reduce the fossil fuel consumption and related pollution.

**CEBY72 INDUSTRIAL WASTEWATER TREATMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart knowledge about the industrial pollution prevention measures.
- To educate students on complete management, principles and treatment of industrial wastewater.

**MODULE I INTRODUCTION** **9**

Industrial scenario in India– Industrial activity and Environment - Uses of water by industry – Sources and types of industrial waste water – Nature and origin of pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling - generation rates, characterization and variables –Toxicity of industrial effluents and bioassay tests – Major issues in water quality management.

**MODULE II INDUSTRIAL POLLUTION PREVENTION** **9**

Prevention and control of industrial pollution – Benefits and barriers – Waste management hierarchy - Source reduction techniques – Pollution prevention and assessment - Material balance - Evaluation of pollution prevention options – Cost benefit analysis – Payback period - Waste minimization circles.

**MODULE III PRICIPLES OF WASTEWATER TREATMENT** **9**

Equalisation - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High rate reactors - Chemical oxidation – Ozonation – Carbon adsorption - Photocatalysis – Wet air oxidation – Evaporation – Ion exchange – Membrane technologies – Nutrient removal - Treatability studies.

**MODULE IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT** **9**

Principles of screening- mixing, Equalization- Sedimentation- Filtration- Modeling, Back washing - Evaporation- Incineration- gas transfer- mass transfer coefficient, adsorption. Isotherms - principles, kinetics, regeneration membrane separation, Reverse osmosis, nano filtration, ultra filtation and hyper filtration electrodialysis, Distillation- Stripping and crystallization- Recent advances.

**MODULE V CASE STUDIES** **9**

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – Metal finishing – Oil Refining – Pharmaceuticals – Sugar and Distilleries.

**Total Hours : 45**

**TEXT BOOKS:**

1. Jeffrey Pierce J., Environmental pollution and control, 4th Edition, Butterworth-Heinemann, 1997.
2. Arceivala, S. J., Wastewater Treatment for Pollution Control, Tata McGraw Hill, 1998.
3. Seader, J. D. and Henley E. J., Separation Processes Principles, John Wiley, 1998.

**REFERENCES:**

1. Nelson Leonard Nemerow, Industrial Waste Treatment – Contemporary Practice and Vision for the Future, Elsevier, Singapore, 2007.
2. Eckenfelder, W.W., Industrial Water Pollution Control, Mc-graw Hill, 2000.
3. Paul L. Bishop, Pollution Prevention : Fundamentals and practice, Mcgraw Hill international, Boston, 2000.
4. World Bank Group, 'Pollution Prevention and Abatement Handbook : Towards Cleaner Production, World Bank and UNEP, Washington D.C., 1998.

**OUTCOMES:**

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

- design a waste water treatment system, components (or) process to meet the desired needs within realistic constraints such as economic, environmental, health, safety and sustainability.
- use the techniques, skills and modern engineering tools necessary for engineering practice.

**CEBY73 IRRIGATION WATER QUALITY AND MODELING** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To impart knowledge about water quality concepts, its estimation and evaluation for irrigation purposes besides relevant environmental problems; and modeling of non-point pollution sources.

**MODULE I CHEMISTRY OF SOIL AND WATER** **7**

Physical and chemical properties of water - Suspended and dissolved solids - EC and pH -Trace constituents – Principles of water quality – Physical and chemical properties of soil - Soil water relationships.

**MODULE II WATER QUALITY ESTIMATION** **9**

Water quality investigation – Sampling design and samplers - Automatic samplers and data collection platforms - Field kits and investigations - Water quality data storage analysis and inference - Software packages - Demonstration on the collection and use of water quality parameters.

**MODULE III EVALUATION OF WATER QUALITY** **10**

Water quality standards - Water quality for irrigation - Salinity and permeability – Irrigation practices for poor quality water - Wastewater irrigation problems and prospects – Saline water irrigation – Future strategies for irrigation problems and prospects - Saline water irrigation – Future strategies.

**MODULE IV WATER QUALITY MODELS** **10**

Water quality in irrigation systems - Diffusion and dispersion processes - Leaching of agrochemicals - Non point source (NPS) models – Agriculture non point source (AGNPS) pollution model.

**MODULE V ENVIRONMENTAL ISSUES RELATED TO WATER QUALITY** **9**

Water quality indices - Agro eco-systems – Sustainable agriculture - Ecological farming principles - Irrigation projects and environmental impacts.

**Total Hours : 45**

## REFERENCES:

1. Masters, G. M., Introduction to Environmental Engineering and Science, Pearson Education, Singapore, 2004.
2. American Public Health Association, Standard methods for the Examination of Water and Wastewater, APHA, New York, 2002.
3. Stum, M. and Morgan, A., Aquatic Chemistry, Plenum Publishing Company, USA, 1985.
4. Lioyd, J. W. and Healthcote J.A., Natural Inorganic Chemistry in Relation to Groundwater Resources, Oxford University Press, Oxford, 1988.
5 Newmann, E. I., Applied Ecology, Blackwell Science Ltd., Oxford, 1996.
6 Sithamparanathan, J., Rangasamy, A. and Arunachalam, N., Ecosystem Principles and Sustainable Agriculture", Scitech publishers, Chennai, 1999.
7 G.L. Asawa, Irrigation and water Resources Engineering, New Age International Publishers, 2006.
8 BIS 11624 : Guidelines for the quality of irrigation water, 1986.
9 BIS 14519 : Guidelines for fixing rates for irrigation water, 1998.

## OUTCOMES:

Upon successful completion of the course, the students will be

- able to perform irrigation water quality evaluation, modeling, sampling and analysis.
- able to give suggestions to improve irrigation water quality.

**CEBY74 PRINCIPLES OF BIOLOGICAL WASTEWATER TREATMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart knowledge about the fundamentals of wastewater treatment in general and various biological treatment units for wastewater treatment in particular.

**MODULE I FUNDAMENTALS OF WASTE WATER TREATMENT 9**

Characteristics of wastewater – pollution parameters – assessment of pollution levels – BOD – COD – pH – interpretation of data - organic load - hydraulic loading – heavy metals present in wastewater – organics and inorganics of industrial wastewater.

**MODULE II AEROBIC TREATMENT OF WASTE WATER 9**

Microbiology of treatment process- Description of activated sludge process - Trickling filter - Rotating biological contactors - Oxidation ponds and stabilization ponds - Sequencing batch reactors and aerated lagoons.

**MODULE III ANAEROBIC TREATMENT OF WASTEWATER 9**

Microbiology of treatment process - Description of anaerobic and facultative stabilization ponds - High rate anaerobic systems - Septic tanks - Imhoff tanks - Sludge digestion process - Tanks and USAB Reactors.

**MODULE IV MISCELLANEOUS TREATMENT PRINCIPLES 9**

Principles of screening- mixing, equalization - Sedimentation- Filtration- Modeling back washing- Evaporation - Incineration - gas transfer - mass transfer coefficient, adsorption - Isotherms - principles, kinetics, regeneration membrane separation, Reverse osmosis, nano filtration, ultra filtation and hyper filtration electrodialysis, distillation- stripping and crystallization- Recent advances.

**MODULE V THEORY AND TREATMENT OF TEXTILE WASTE WATER 9**

Identification and reduction of pollution sources in textile wet processing - Pollution control in man made fibre industry - Analysis of textile processing effluents- colour, odour, pH, total solids, suspended solids, total dissolved solids, BOD, COD, total alkalinity, chloride, sulphates, calcium and chromium -

tolerance limits for effluents - Bio-degradability of textile chemicals and auxiliaries. Adsorption isotherms, thermo dynamics of dyeing - dye affinity, activity of dyes, heat of dyeing, entropy, rate of dyeing and half dyeing time.

**Total Hours : 45**

**TEXT BOOKS:**

1. Grady, C.P.L., Daigger, G. and Lim, H.C., Biological Wastewater Treatment, 2nd Edn., Marcel Dekker, 1998.
2. Mirazhi, A. , Biological Waste water Treatment, John Wiley Sons Inc., 1989.
3. Lee, C.C. and shun dar lin, Handbook of Environmental Engineering Calculations, Mcgraw Hill, New York, 1999.

**REFERENCES:**

1. Metcalf and Eddy, Wastewater Engineering - Treatment and Reuse, Tata Mcraw Hill, New Delhi, 2003.
2. Eckenfelder, W.W., Industrial Water Pollution Control, Mc-graw Hill, 2000.
3. Paul L. Bishop, Pollution Prevention : Fundamentals and Practice" , Mcgraw Hill international, Boston, 2000.
4. Hendricks, D. water Treatment Unit Processes – Physical, Chemical and Biological, CRC press, New York, 2006.

**OUTCOMES:**

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

- test, analyse and interpret waste water quality.
- design various waste water treatment units based on the treatment principles.

**CEBY75 SUSTAINABLE AND GREEN BUILDING DESIGN**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart knowledge about the various aspects of sustainable and green building design in the context of global warming and climate change.
- To expose students on very process and tools to design building architecture which is environmental friendly and sustainable.

**MODULE I INTRODUCTION** **9**

Attitudes to architecture: a historical perspective - General premises and strategies for sustainable and green design- objectives and basis - Eco-mimicry as a design tool based on ecosystem analogy - Theoretical basis for a sustainable and eco friendly design.

**MODULE II ECO HOUSE** **9**

The form of the house: the building as an analogy - Design from first principles: conserving energy - Working with climate: passive solar design - Minimizing new resources - Respect for users - respect for site and holism - Photovoltaic's and solar hot water systems - Water usage - Small scale wind systems and hydro power.

**MODULE III ENVIRONMENTAL IMPACT OF BUILDING MATERIALS** **9**

Measuring the impact of building materials - calculating embodied energy - Recycling and embodied energy - processing and embodied energy - time and embodied energy - embodied energy of different building materials - low energy building and masonry materials - life cycle analysis.

**MODULE IV GREEN CONSTRUCTION AND ENVIRONMENTAL QUALITY** **9**

Sustainable architecture and Green Building : definition - Green building evaluation systems - LEED Certification - Green Globe Certification.

**MODULE V SUSTAINABLE AND GREEN BUILDING DESIGN STUDIO** **9**

Case studies - Project on design of eco houses applying various parameters of sustainability. Case studies which look at the environmental approach-

renewable energy - controlling the water cycle- impact of materials on the environment – optimizing construction - site management - environmental management of buildings.

**Total Hours : 45**

**TEXT BOOKS:**

1. Ken Yeang, Eco design - A Manual for Ecological design, Wiley- Academy, 2006.
2. Sue Roaf et al., Eco-house : A design Guide, Elsevier Architectural Press, 2007.
3. Thomas E. Glavinich, Green Building Construction, Wiley, 2008.

**REFERENCES:**

1. Brenda and Robert Vale, Green Architecture - Design for a Sustainable Future, Thames and Hudson, 1996.
2. Daniel Vallero and Chris Brasier, Sustainable Design - The science of Sustainability and Green Engineering, Wiley, 2008.
3. Catherine Slessor, Sustainable Architecture and High Technology - Eco Tech., Thames and Hudson, 1997.
4. Dominique Gauzin-Muller, Sustainable Architecture and Urbanism, Birkhauser, 2002.

**OUTCOMES:**

Upon successful completion of the course, student will

- gain knowledge about strategies for sustainable building design and green building evaluation system.
- be able to assess the environmental impact of building materials.
- be capable of applying various parameters of sustainability for building design.

**CEBY76 PERFORMANCE EVALUATION OF BUILDINGS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To impart knowledge about the various simulation models of dynamic building envelope, thermal performance, experimental techniques for performance evaluation of the building envelope, cost savings using commercially available software packages, verification of compliance with standards and life cycle analysis.

**MODULE I SIMULATIONS AND DESIGN OF BUILDINGS** **9**

Principles of modeling and simulation – Classification and validation of simulation models – Analysis of input data and outputs – Object oriented simulation (OOS) – Simulation languages – Application of discrete event simulation in construction operations including earthmoving operations – building construction operations, and tunneling operations.

**MODULE II THERMAL BUILDING SIMULATION** **9**

Mathematical models of heat and mass transfer phenomena through building components: transfer function methods and numerical methods – Models of radiative and convective heat transfer phenomena within buildings – Application to equipment-based modeling of HVAC systems: first principle models and correlation–based models – System–based modeling of HVAC systems – Validation of computer models.

**MODULE III PERFORMANCE OF BUILDING ENVELOPE** **9**

Modeling of dynamic building envelope thermal performance – Thermal bridges– modeling – Advanced glazing and evaluation of window performance – Active building envelope components for heat and moisture control.

**MODULE IV ENERGY MANAGEMENT IN BUILDINGS** **9**

Energy – related standards – codes – by-laws – Methods of assessment of the actual energy performance - Conventional – Innovative measurement – Analysis techniques – Energy-oriented renovation or replacement of building sub-systems.

**MODULE V EXPERIMENTAL TECHNIQUES 9**

Experimental techniques for performance evaluation of the building envelope. Prediction of energy – cost savings using commercially available software packages – Verification of compliance with standards – Life cycle analysis.

**Total Hours: 45**

**REFERENCES:**

1. Moneef Krarti ,Energy Audit of Building Systems, CRC Press, 2000.
2. Clarke, J.A., Energy simulation in building design, Adam Hilger Ltd., Bristol, 1985.
3. ESRU, ESP-r A Building Energy Simulation Environment, User Guide Version 9 Series, ESRU Manual U 96/1, University of Strathclyde, Energy Systems Research Unit, Glasgow, 1996.
4. Kabele, K., Modelling and Analyses of Passive Solar Systems with Computer Simulation, Proc. Renewable Energy Sources, Czech Society for Energetics Kromeriz, Czech, 1998.

**OUTCOMES:**

Upon successful completion of the coursework, the student will

- Be equipped with the knowledge of performance evaluation of buildings, energy related standards, codes, assessment of actual energy performance and thermal building simulation.
- Be able to apply the gained knowledge & techniques for performance evaluation of the building envelope.

**CEBY77 REMOTE SENSING IN FORESTRY L T P C**
**3 0 0 3**

**OBJECTIVES:**

To impart knowledge about the basics of forestry and how remote sensing technology will be helpful to solve the problems of forestry.

**MODULE I INTRODUCTION TO FORESTRY 9**

Forestry – Introduction - Fundamental concept and Role of RS and GIS in Forestry. Dynamics of forest ecosystem and forest canopy - Inventory of forest land -Temperate and tropical zones - Forest Classification, types and their distribution.

**MODULE II SPECTRAL CHARACTERISTICS OF VEGETATION 9**

Photosynthesis fundamentals - Spectral characteristics of vegetation - temporal characteristics of vegetation - Vegetation Indices.

**MODULE III RELATIONSHIP OF VEGETATION TO ROCK TYPES AND FOREST COVER MAPPING 9**

Relationship of vegetation to rock types – Geobotanical guides for rock and mineral identification - Vegetation type and density mapping/classification - Mapping of plant in stress condition - Forest cover mapping and change detection.

**MODULE IV FOREST FIRE AND FOREST DAMAGE ASSESSMENT 9**

Microwave data interpretation in thick forest cover area - Seasonal plant condition and reflectance variation - Forest Fire–identification, forecasting, and risk area mapping. Remote sensing in forest damage assessment and disease detection.

**MODULE V FOREST CHARACTERIZATION AND FOREST MANAGEMENT SYSTEM 9**

Biodiversity characterization and biomass estimation - Wildlife habitat mapping - Role of remote sensing in forest management and forest recreation - Forest management information system.

**Total Hours : 45**

**REFERENCES:**

1. Anji Reddy, M., Geoinformatics for Environmental Management, B.S. Publications, New Delhi, 2004.
2. Franklin, S.E., Remote Sensing for Sustainable Forest Management, Lewis Publications, 2001.
3. Gupta, R.P., Remote Sensing Geology , Springer Verlag, 1990.
4. Jensen, J.R., Remote Sensing of the Environment : An Earth Resource Perspective, Prentice Hall, 2000.

**OUTCOMES:**

- At the end of the course, student will be able to solve problems related to forestry with the use of appropriate technology in image processing.

**CEBY78 RADAR IMAGE PROCESSING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To impart knowledge about radar image processing and its applications.

**MODULE I BASICS 6**

Introduction, imaging Radar – Radar systems, Basic instrumentation – System parameters – wave length – polarization – resolution – Radar geometry, Radar equation, image geometry.

**MODULE II ENVIRONMENTAL AND TARGET PARAMETERS 9**

Concept of roughness, geometry of targets, dielectric constant, resonance backscattering – point targets, surface and volume scattering, surface scattering models, reflection, bragg resonance, cross swath variation and surface envelop.

**MODULE III IMAGE PROCESSING OF RADAR DATA 9**

Spectra and offsets, depth of focus, processor timing and complexity versus resolution, focused electronic processing, unfocussed processing, optical processing, speckle and grey scale resolution, power consideration, antenna and receiver gain correction for scattering coefficient and range, matching system elements, motion effects, synthetic, aperture radar ambiguity problems, processing of SAR data, Image Interpretation techniques.

**MODULE IV IMAGING RADAR INTERFEROMETRY 12**

Basic concept, interferometry principles, data selection, interferogram generation, choosing interferogram pairs, base line, SAR processing, registration, interferometric topographic mapping, velocity mapping, change mapping and geosciences applications, differential SAR interferometry (D - INSAR), geometry of D INSAR, techniques, comparison, software for processing, phase unwrapping, DEM generation, deformation extraction and analysis, volcano, earthquake and snow glacier applications.

**MODULE V ADVANCED TOPICS 9**

Radargrammetry - introduction, basic equations, projection equations, relief displacement, matching radar images and digital terrain models, geometric

rectification, stereoscopic radar analysis, parallax radargrammetry, mosaicing, digital mosaicing, applications; Radar polarimetry - basic equations, antenna concepts, Target concepts, optimum polarization for maximum power, co-polarization and cross polarization, geosciences application; scatterometer data processing; altimeter data processing.

**Total Hours : 45**

**REFERENCES:**

1. Giorgio Franceschetti and Riccardo Lanari, Synthetic Aperture Radar Processing, CRC Press, 1999.
2. Floyd. M. Handerson and Anthony, J. Lewis, Principles and Applications of Imaging RADAR, Manual of Remote sensing, Third edition vol.3, ASPRS, Jhumurley and sons Inc.,1998.
3. Ulaby, F.T., Moore, K.R. and Fung, Microwave Remote Sensing, Addision-Wesley Publishing Compan, London, 2001.
4. Franz W. Leberl, Radar Grammetric Image Processing, Artech House Original, University of Michigan, 2007.
5. Roger J Sullivan and Knovel, Radar Foundations for Imaging and Advanced Concepts", SciTech Publishers, 2004.
6. Ian Faulconbridge, Radar Fundamentals, Argos Press, 2002.

**OUTCOMES :**

- At the end of the course, student will be able to interpret and process the microwave data and apply it for various applications.

| CEBY15 | MAINTENANCE AND REHABILITATION OF STRUCTURES | L | T | P | C |
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**OBJECTIVES:**

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

**MODULE I CAUSES FOR FAILURES** **9**

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

**MODULE II MAINTENANCE AND ASSESSMENT PROCEDURE** **9**

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

**MODULE III MATERIALS FOR REPAIR** **9**

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

**MODULE IV TECHNIQUES FOR REPAIR** **9**

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

**MODULE V REHABILITTION OF STRUCTURES - CASE STUDIES 9**

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

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

At the end of course work, the students will

- have sufficient knowledge on various causes of failures and detailed procedure for evaluating a distressed structure.
- be familiar with materials available for repair and techniques for rehabilitating structural elements.
- obtain field knowledge on rehabilitation of real time distressed structures through case studies.

**MAB682 OPTIMIZATION TECHNIQUES L T P C**
**3 1 0 4**

**OBJECTIVES:**

- Introduce methods of optimization to engineering students, including linear programming, network flow algorithms, integer programming, interior point methods, quadratic programming, nonlinear programming, and heuristic methods.
- The goal is to maintain a balance between theory, numerical computation, problem setup for solution by optimization techniques, and applications to engineering systems.

**MODULE I INTRODUCTION 7**

Overview of Optimization techniques for Civil Engineering Problems - Introduction to methods of optimization - Classification of Optimization problems - optimality and convexity - General optimization algorithm - necessary and sufficient conditions for optimality.

**MODULE II LINEAR PROGRAMMING 8**

Introduction to linear programming - a geometric perspective - Standard form in linear programming; basic solutions; fundamental theorem of linear programming - Simplex Algorithm for Solving Linear Programs - Duality; complementary slackness; economic interpretation of the dual; Sensitivity analysis; right-hand-side and cost ranging.

**MODULE III DYNAMIC PROGRAMMING 8**

Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP); Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP.

**MODULE IV APPLICATIONS 8**

Regression modeling in engineering; industrial blending problems; dynamic optimal control of engineering systems; optimal estimation in environmental engineering - Water resources; production planning in industrial engineering;

transportation problem - Heuristic optimization methods: genetic algorithms; ecological engineering application; Minimum cost network flow algorithms; out-of-kilter method; primal-dual methods; Dynamic Programming Applications - Water allocation as a sequential process - Capacity expansion and Reservoir operation.

**MODULE V INTEGER PROGRAMMING 8**

Integer programming - applications in optimal irrigation scheduling in agricultural engineering - Interior point optimization methods - affine scaling method.

**MODULE VI NON-LINEAR PROGRAMMING 6**

Non-linear programming - Kuhn-Tucker conditions for constrained nonlinear programming problems; necessary and sufficient conditions; quadratic programming; applications.

**L – 45; T – 15; Total Hours: 60**

**REFERENCES:**

1. Taha, H.A., Operations Research - An Introduction , 9th edition, Pearson Prentice Hall, 2011.
2. Winston.W.L. 'Operations Research', Fourth Edition, Thomson – Brooks/ Cole, 2003.
3. Kreyszig .E., Advanced Engineering Mathematics, 10th edition., John Wiley and Sons Asia Pvt. Ltd., Singapore, 2001.

**OUTCOMES:**

At the end of the course, the students will gain on knowledge on

- basic theoretical principles in optimization
- formulation of optimization models
- solution methods in optimization
- methods of sensitivity analysis and post processing of results
- applicability of optimization techniques to a wide range of engineering problems

**SSB7181 SOCIETY, TECHNOLOGY AND SUSTAINABILITY**

| L | T | P | C |
|---|---|---|---|
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**OBJECTIVES:**

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- 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** **9**

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** **9**

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** **9**

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** **9**

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** **9**

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.