w.e.f: 2015-16 **M.Tech-15**

ACADEMIC REGULATIONS
MASTER OF TECHNOLOGY
(MTECH-15) w. e. f: 2015-2016

(Common to all branches)

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(An Autonomous, ISO 9001:2008 Certified Institution)
(Approved by AICTE, Accredited by NAAC with 'A' Grade, Affiliated to JNTUK, Kakinada)
(Sponsored by Siddhartha Academy of General & Technical Education)
Kanuru, Vijayawada
Andhra Pradesh - 520007, INDIA.
www.vrsiddhartha.ac.in

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(Autonomous)
Kanuru, Vijayawada – 520 007
(Approved by AICTE, Accredited by NAAC with 'A' Grade,and ISO 9001: 2008 Certified)
(Affiliated to Jawaharlal Nehru Technological University, Kakinada)

Academic Regulations for M. Tech (MTECH-15) w. e. f: 2015-2016

(Common to all branches)

1. INTRODUCTION

Academic Programmes of the College are governed by rules and regulations as approved by the Academic Council, which is the highest Academic Body of the Institute. These academic rules and regulations are effective from the academic year 2015-16, for students admitted into two year PG programme offered by the college leading to Master of Technology (M. Tech).

The regulations listed under this head are common for postgraduate programmes, leading to award of M. Tech degree, offered by the college with effect from the academic year 2015-16 and they are called as "M. TECH-15" regulations.

The regulations hereunder are subjected to amendments as may be made by the Academic Council of the college from time to time, keeping the recommendations of the Board of Studies in view. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the programme, as may be decided by the Academic Council.

2. DEFINITIONS

a) "Commission" means University Grants Commission (UGC)
b) "Council" means All India Council for Technical Education (AICTE)
c) "University" means Jawaharlal Nehru Technological University Kakinada, Kakinada (JNTUK)
d) "College" means Velagapudi Ramakrishna Siddhartha Engineering College (VRSEC)
e) "Programme" means any combination of courses and/or requirements leading to the award of a degree
f) "Course" means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.
g) "Degree" means an academic degree conferred by the university upon those who complete the postgraduate curriculum.

3. PROGRAMMES OFFERED

The nomenclature and its abbreviation given below shall continue to be used for the degree programmes under the University, as required by the Council and Commission.

Master of Technology (M. Tech) Besides, the name of the programme shall be indicated in brackets after the abbreviation. For example PG engineering degree in Computer Science and Engineering is abbreviated as M. Tech (Computer Science and Engineering).

Presently, the college is offering Post Graduate programme in Engineering with the following programmes:

Table 1: List of Programmes offered by college leading to M. Tech Degree

S. No	Programme	Department
1	Structural Engineering	Civil Engineering
2	Computer Science and Engineering	Computer Science and Engineering
3	Power Systems Engineering.	Electrical and Electronics Engineering
4	Communication Engineering and Signal Processing	Electronics and Communication Engineering
5	Telematics	
6	VLSI Design and Embedded Systems	
7	Computer Science & Technology	Information Technology
8	CADCAM	Mechanical Engineering
9	Thermal Engineering	

These Regulations shall be applicable to any new postgraduate programme (M. Tech) that may be introduced from time to time.

4. DURATION OF THE PROGRAMME

- The duration of the programme is two academic years consisting of four semesters.
- A student is permitted to complete the programme within a maximum duration of 4 years.

5. MINIMUM INSTRUCTION DAYS

- Each semester shall consist of a minimum of 90 instruction days with about 25 to 35 contact periods per week.

6. ELIGIBILITY CRITERIA FOR ADMISSION

- The eligibility criteria for admission into M.Tech programme are as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

6.1 CATEGORY –A Seats:

- These seats will be filled by the Convener, PGECET Admissions.

6.2 CATEGORY –B Seats :

- These seats will be filled by the College as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

7. PROGRAMME STRUCTURE

The programme structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their post-graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories to cover the depth and breadth required for the programme and for the attainment of programme outcomes of the corresponding programme.

7.1 Programme Core:

The core consists of set of courses considered necessary for the students of the specific. The courses under this category should satisfy the programme specific criteria prescribed by the appropriate professional societies. The credits for programme core courses is 40.

7.2 Programme Electives:

The electives are set of courses offered in the which covers depth and breadth to further strengthen their knowledge. The students may register for appropriate electives offered in the based on their area of interest. The credits for the programme electives are 12.

7.3 Independent Learning:

The students are expected to learn the courses offered under this category on their own. The courses offered under this category include:

7.3.1 Self-Learning Course:

The self-learning courses shall be taken from the list of approved MOOCs in the respective Board of Studies. The courses under this category shall carry two credits.

7.3.2 Seminar:

One seminar shall be delivered by the students as individual presentation. The seminar topics shall be related to the contemporary aspects of the programme and approved by the Seminar Review Committee (SRC) to be constituted by HOD with minimum two members related to programs specialization. The seminar shall carry 2 credits.

- The self learning course and seminar shall be offered either in 1st year or in 2nd year of the programme depending upon this scheme approved by BOS & Academic Council.

7.3.3 Project:

The Project shall be offered in 2nd year of the programme. The project shall be carried out by the students, as individual project, for a minimum period of one academic year. The project shall be carried out in the major areas pertaining to the programme approved by Project Review Committee and may address the societal problems/issues related to the programme. The project shall consist of Part-A and and Part-B carrying 10 and 14 credits, respectively spreading over for one semester each. The project part B shall be the extension of project Part A.

- If the candidate wishes to change his/her topic of the project, he/she can do so with approval of the project review committee within one week from the completion of 1st review.

7.3.3.1 PROJECT WORK IN COLLABORATION WITH INDUSTRY**:**

- A student may, with the approval of the Head of the Department/Centre, visit an industry or a Research Laboratory for data collection, discussion of the project, experimental work, survey, field studies, etc. during the project period. Projects sponsored by the industry or Research Laboratories will be encouraged and a close liaison with such organizations will be maintained.

- A student may, with the approval of Project Review Committee, do the project work in collaboration with an industry, a Research and Development Organization. The student shall acknowledge the involvement and / or contribution of an industry, R&D organization in completing the project in his/her thesis and a certificate to this effect, issued by the supervisor from the industrial organization, will be included in the thesis.

- It is mandatory for all students (especially those who do their project in an Industry, R&D organization in India or abroad) to make full disclosure of all data on which they wish to base their project. They cannot claim confidentiality simply because it would come into conflict with the Industry's or R&D laboratory's own interests. Any tangible intellectual property other than copyright of the thesis may have to be assigned to the Institute. The copyright of the thesis itself would however lie with the student as per the IPR policy in force.

- In addition to the internal guide from the department/center guiding the project work, a Joint Supervisor may be appointed from the Industry and Research Laboratory with the approval of the HOD. A certificate from the joint supervisor will be included in the thesis. A member of faculty of the Institute, who is the internal supervisor, may, if felt necessary, visit the industry or the Research Laboratory in connection with the project work of his/her student.

7.4 Course Code and Course Numbering Scheme

Course Code consists of eight characters in which the first four are alphabets and the rest are numerals. The first four characters are described in Table 2 and 3.

Table 2: First and Second Character description

First Two Characters	Name of the Department
CE	Civil Engineering Department
CS	Computer Science and Engineering Department
EC	Electronics & Communication Engineering Department
EE	Electrical & Electronics Engineering Department
IT	Information Technology Department
ME	Mechanical Engineering Department

The third and fourth character represents specialization offering as mentioned in Table No. 3.

Table 3: Third and Fourth Character description

Next Two Characters	Name of the Specialization
SE	Structural Engineering
CS	Computer Science and Engineering
SP	Communication Engineering and Signal Processing
VE	VLSI Design and Embedded Systems
TM	Telematics
PS	Power Systems Engineering
CT	Computer Science & Technology
CC	CADCAM
TE	Thermal Engineering

For all the fifth and sixth characters represent semester number and syllabus

version number of the course offered.

Seventh character represents course type, as per Table No. 4

Table 4: Course type description

SEVENTH CHARACTER	DESCRIPTION
0	Theory course
5	Lab course

Eighth character represents course number as described in Figure 1 below. However, few courses are given distinct codes.

For example, in **MECC 1051** course, the course is offered by Mechanical Engineering Department (**ME**) in CAD/CAM specialization offered in the first semester (**1**), the course syllabus version number (**0**), the course is of lab type (**5**) and the course number is (**1**), as given in figure.2 below.

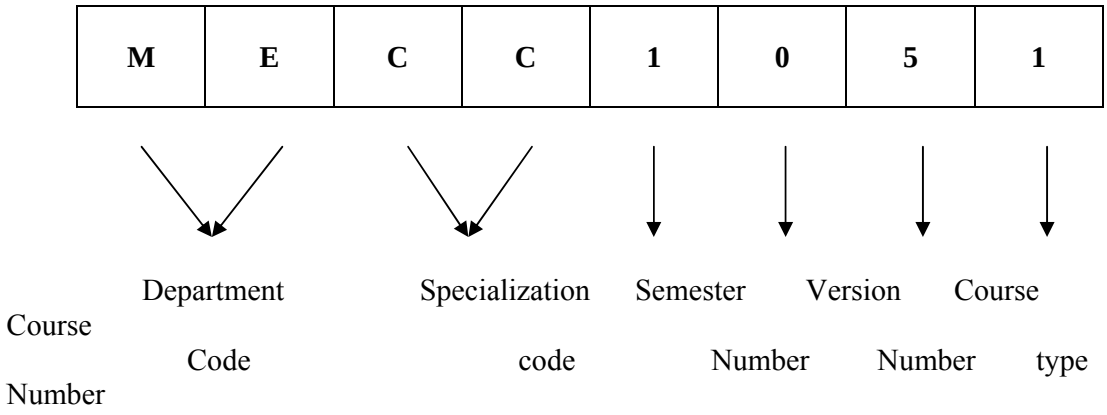

Figure 1: Course Code Description

7.5 Scheme of Instruction for 1st and 2nd Years

- The scheme of instruction and exact syllabi of all post graduate programmes are given separately.

7.6 Contact Hours and Credits

Credit means quantifying and recognizing learning. Credit is measured in terms of contact hours per week in a semester.

The Course Credits are broadly fixed based on the following norms:

- Lectures – One Lecture period per week is assigned one credit.
- Tutorials - Two tutorial periods per week are assigned one credit.
- Practical – 2 periods per week is assigned one credit

- Seminar/Mini Project shall have 2 credits.
- Major Project shall have 24 credits.
- However, some courses are prescribed with fixed number of credits depending on the subject complexity and importance.

7.7 Theory / Tutorial Classes

Each course is prescribed with fixed number of lecture periods per week. During lecture periods, the course instructor shall deal with the concepts of the course. For certain courses, tutorial periods are prescribed, to give exercises to the students and to closely monitor their learning ability.

7.8 Laboratory Courses

A minimum prescribed number of experiments have to be performed by the students, who shall complete these in all respects and get each experiment evaluated by teacher concerned and certified by the Head of the Department concerned at the end of the semester.

7.9 Programme Credits

Each specialization of M.Tech programme is designed to have a total of 80 credits, and the student shall have to earn all the credits for the award of degree.

8. MEDIUM OF INSTRUCTION

The medium of instruction and examination is English.

9. SYLLABUS

As approved by the concerned BOS and the Academic Council.

10. ELIGIBILITY REQUIREMENT FOR APPEARING SEMESTER END EXAMINATION AND CONDONATION

- A regular course of study means a minimum average attendance of 75% in the semester computed by totaling the number of periods of lectures, tutorials, practical courses and project as the case may be, held in every course as the denominator and the total number of periods attended by the student in all the courses put together as the numerator.

- Condonation of shortage in attendance may be recommended by the respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student.

- Students, having shortage of attendance, shall have to pay the requisite fee towards condonation**.**

- Minimum of 50% aggregate marks must be secured by the candidates in the continuous evaluations conducted in that semester for courses such as theory, laboratory courses and project to be eligible to write semester end examinations. However, if the student is eligible for promotion based on the attendance, in case necessary, a shortage of internal marks up to a maximum of 10% may be condoned by the Principal based on the recommendations of the Heads of the Departments.

- Students having shortage of internal marks up to a maximum of 10% shall have to pay requisite fee towards condonation**.**

- A student, who does not satisfy the attendance and/or internal marks requirement, shall have to repeat that semester.

- Eligible candidates who failed to register for all courses for the semester-end examinations shall not be permitted to continue the subsequent semester and has to repeat the semester for which he/she has not registered for semester end examinations.

11. EXAMINATIONS AND SCHEME OF EVALUATION

11.1 Continuous Evaluation:

11.1.1 Theory Courses

Each course is evaluated for **40** marks (a+b)

a) The internal evaluation shall be made based on the two midterm examinations each of 2**0** marks will be conducted in every theory course in a semester. The mid term marks shall be awarded giving a weightage of 2/3rd in the examination in

which the student scores more marks and 1/3rd for the examination in which the student scores less marks. Each midterm examination shall be conducted for duration of 90 minutes without any choice**.**

b) The remaining 20 marks are awarded through continuous evaluation of assignments / mini project in each subject as notified by the teacher at the beginning of the semester.

Students shall be informed regarding the comprehensive assignment/ during the first week of the semester and they have to submit completed assignment on or before 12th week of semester.

11.1.2 Laboratory Courses: 40 marks

- For Laboratory courses there shall be continuous evaluation during the semester for 40 internal marks. The distribution of internal marks is given below:

Table 5: Distribution of Marks

Sl. No.	Criteria	Marks
1	Day to Day work	10
2	Record	10
3	Continuous Evaluation	20

11.1.3 Seminar: 40 marks

The distribution of internal marks for the seminar is given below.

Table 6: Distribution of Marks

Sl. No.	Criteria	Marks
1	Report	15
2	Presentation	15
3	Viva-voce	10

11.1.4 Project: (40 marks)

The continuous evaluation (Project Part A and Project Part B) for 40 marks shall be on the basis of two seminars by each student on the topic of his/her and evaluated by a review committee and the day to day assessment by the supervisor in respective semester. The review committee consists of HOD, Programme Coordinator, respective internal guide and two senior faculty members of the department with expertise in the specialization nominated by HOD. The distribution of marks is as follows in Table 7.

Table 7: Continuous internal assessment in each semester

Sl. No.	Criteria	Marks
1	Two reviews	15+15
2	Day to day assessment	10

Rubrics shall be prepared by review committee using appropriate performance indicators for each review separately and informed to the students well in advance.

11.1.5 Self-Learning Courses

For the courses under this category, the distribution of marks for continuous evaluation will be same as theory courses (Section 11.1.1).

11.2 SEMESTER END EXAMINATIONS

11.2.1 Theory Courses: 60 marks

The Semester end examinations shall be conducted for 3 hours duration at the end of the semester. The question paper shall be given in the following pattern: There shall be two questions from each unit with internal choice. Each question carries 15 marks. Each course shall consist of four units of the syllabus.

11.2.2 Lab Courses: 60 marks

40 marks are allotted for experiments/job works & **15** marks are allotted for viva-voce examination and **5** marks for the record.

11.2.3 Seminar: 60 marks

There shall be a seminar presentation. For Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department, supervisor and two other senior faculty members of the department. For Seminar, the evaluation is done for 60 marks internally. A candidate has to secure a minimum of 50% to be declared successful.

11.2.4 Self-Learning Courses: 60 marks

The semester end examinations for courses under this category are evaluated for 60 marks.

11.2.5 Project: 60 marks

The project (Project Part A and Part B) shall be evaluated for 60 marks in respective semesters. The semester end examination for project part – A shall be evaluated by Project Review Committee (PRC) as per 11.1.4 and project part – B shall be evaluated by a project evaluation committee consisting of the Head of the Department, project internal guide and an external examiner nominated by the Principal.

The rubrics for evaluation of semester end examination shall be defined by the Project review committee.

12. CONDITIONS FOR PASS AND AWARD OF CREDITS FOR A COURSE

12.1 Conditions for Pass and award of Grades & Credits:

a) A candidate shall be declared to have passed in individual Theory course if he/she secures a minimum of 50% aggregate marks (Internal & semester end examination marks put together), subject to a minimum of 40% marks in the semester end examination.

b) A candidate shall be declared to have passed in individual labs/ course if he/she secures a minimum of 50% aggregate marks (Internal & semester end examination marks put together), subject to a minimum of 50% marks in the semester end examination.

c) If a candidate secures minimum of 40% marks in Theory Courses in the semester end examination and 40% - 49% of the total marks in the semester end examination and internal evaluation taken together in some theory courses and secures an overall aggregate of 50% in all theory courses in that semester he/she declared to be passed in the theory courses of that semester in regular Examinations. This provision is applicable for Regular candidates only during Regular Semester – end Examinations.

d) The student has to pass the failed course by appearing the examination when offered next, as per the requirement for the award of degree.

e) A candidate shall be declared to have passed the project part A/project part B, if he/she secures minimum of 50 % aggregate marks (continuous evaluation and semester end examination put together), subjected to a minimum of 50 % of marks in semester end examinations.

f) If any candidate does not fulfill the pass requirement as per 12.1.(e) in semester end examination of Project Part – A, he / she will be given two months additional time to re appear at the semester end examination after paying the requisite examination fee and also the candidate has to borne the expenditure for conducting examination. If the candidate does not fulfill the pass requirement again in Project Part – A as per 12.1(e), he/she has to repeat the semester in next academic year.

g) In a special case, if any student does not submit his / her thesis of Project Part – B, due to ill health or any other reason, he / she will be given another chance to attend for Project, Viva – Voce examination conducted separately at a later date i.e. within two months from the completion of Project Part – B semester end examination of that particular academic year after paying the requisite examination fee, if the expenditure for conducting Project Part – B is completely borne by the candidate.

h) On passing a course of a programme, the student shall earn assigned credits in that

Course.

12.2 Method of Awarding Letter Grades and Grade Points for a Course.

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table 8: Grading System for individual subjects/labs

Theory	Lab/	Grade Points	Letter Grade
>= 90%	>= 90%	10	Ex
80-89%	80-89%	9	A+
70-79%	70-79%	8	A
60-69%	60-69%	7	B

50-59%	55-59%	6	C
45-49%	50-54%	5	D
40-44%	-	4	E
< 40%	< 50%	0	F (Fail)
ABSENT	ABSENT	0	AB

12.3 Calculation of Semester Grade Points Average (SGPA)* and award of division for the program.

The performance of each student at the end of the each semester is indicated in

terms of SGPA. The SGPA is calculated as below:

$$SGPA = \frac{\sum(CR \times GP)}{\sum CR}$$ (For all courses passed in semester)

Where CR= Credits of a course

GP = Grade points awarded for a course

*SGPA is calculated for the candidates who passed all the courses in that semester.

12.4 Calculation of Cumulative Grade Point Average (CGPA) for Entire Programme.

The CGPA is calculated as below:

$$CGPA = \frac{\sum(CR \times GP)}{\sum CR}$$ (For entire programme)

Where CR= Credits of a course

GP = Grade points awarded for a course

Table 9: Award of Divisions

CGPA	DIVISION
≥7.75	First Class with distinction
≥6.5 - <7.75	First Class
≥5.5 - <6.5	Second Class
≥4 - <5.5	Pass Class
<4	Fail

For the purpose of awarding first class with distinction, the candidate should complete the programme with in 2 years and should get required CGPA.

Detained, Break in study candidates, and the candidates who availed themselves of the opportunity of extension of project part – B for a further period of two months are not eligible for the award of first class with distinction.

For the purpose of awarding first/ second/ pass class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course including extensions in project, if any shall be considered.

12.5 Transitory Regulations

A candidate, who is detained or discontinued in the semester, on readmission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently and the academic regulations be applicable to him/her which have inforce at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional subjects are to be studied as approved by Board of Studies and ratified by Academic Council.

12.6 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the candidates will be issued after completion of the two years M. Tech Programme.

13. REVALUATION

- As per the notification issued by the Chief Controller of Examinations, the students can submit the applications for revaluation, along with the fee receipt for revaluation of his/her answer script(s) of theory course(s), if he/she is not satisfied with marks obtained.
- The Controller of Examinations shall arrange for revaluation of those answer script(s).
- A new external examiner, other than the first examiner, shall reevaluate the answer script(s).

- Better marks of the two will be taken into consideration.

14. READMISSION CRITERIA

A candidate, who is detained in a semester due to lack of attendance/marks, has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying an administrative fee of Rs. 1,000/-

15. BREAK IN STUDY

Student, who discontinues the studies for whatsoever may be the reason, can get readmission into an appropriate semester of M. Tech program after a break-in study only with the prior permission of the Principal of the College provided such candidate shall follow the transitory regulations applicable to such batch in which he/she joins. An administrative fee of Rs. 2000/- per each year of break in study in addition to the prescribed tuition and special fee has to be paid by the candidate to condone his/her break in study.

16. ELIGIBILITY FOR AWARD OF M.TECH. DEGREE

The M. Tech., Degree shall be conferred on a candidate who satisfies the following requirement. A student should register himself for 80 Credits, and should obtain all the 80 credits in order to become eligible for the award of M.Tech Degree.

17. CONDUCT AND DISCIPLINE

- Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the students of our Institute.
- As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offense and is banned. Any form of ragging will be severely dealt with.
- The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

i. Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.

ii. Willful damage or distribution of alcoholic drinks or any kind of narcotics to fellow students /citizens.

The following activities are not allowed within the campus

- Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
- Mutilation or unauthorized possession of library books.
- Noisy and unseemly behavior, disturbing studies of fellow students.
- Hacking computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cyber crime etc.
- Use cell phones in the campus.
- Plagiarism of any nature.
- Any other act of gross indiscipline as decided by the college from time to time.
- Commensurate with the gravity of an offense, the punishment may be reprimanded, fine, expulsion from the institute / hostel, debarment from a examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

- For an offense committed in (i) a hostel (ii) a department or in a classroom and (iii) elsewhere, the Chief Warden, the Head of the Department and the Principal, respectively, shall have the authority to reprimand or impose fine.
- Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Principal for taking appropriate action.
- Unauthorized collection of money in any form is strictly prohibited.
- Detained and Break-in-Study candidates are allowed into the campus for academic purposes only with permission from the authorities.
- Misconduct committed by a student outside the college campus, but having the effect of damaging, undermining & tarnishing the image & reputation of the institution will make the student concerned liable for disciplinary action commensurate with the nature & gravity of such misconduct.
- The Disciplinary Action Committee constituted by the Principal, shall be the authority to investigate the details of the offense, and recommend disciplinary action based on the nature and extent of the offense committed.
- "Grievance appeal Committee" (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative /disciplinary matters.
- All the students must abide by the code and conduct rules of the college.

18. MALPRACTICES

- The Principal shall refer the cases of malpractices in internal assessment tests and Semester-End Examinations, to a Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students based on the recommendations of the committee.
- Any action on the part of the candidate at an examination trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all

concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

19. OTHER MATTERS

19.1 The physically challenged candidates who have availed additional examination time and a scribe during their B. Tech/PGECET/GATE examinations will be given similar concessions on production of relevant proof/documents.

19.2 Students who are suffering from contagious diseases are not allowed to appear either internal or semester end examinations.

19.3 The students who participated in coaching/tournaments held at the state / National /International levels through University / Indian Olympic Association during the end semester external examination period will be promoted to subsequent semesters till the entire course is completed as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated 18-08-1994.

19.4 The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved in the Heads of the Departments Meetings, shall be reported to the academic council for ratification.

20. AMENDMENTS TO REGULATIONS

The Academic Council may, from time to time, revise, amend, or change the regulations, Schemes of examination and/or syllabi.

COURSE STRUCTURE AND SCHEME OF EVALUATION
M.TECH – STRUCTURAL ENGINEERING
I Semester

S.No	Subject Code	Subject Title	T	P	C	I	E	T
1	CESE 1001	Theory of Elasticity and Plates	4		4	40	60	100
2	CESE 1002	Dynamics of Structures	4		4	40	60	100
3	CESE 1003	Matrix Methods of Structural Analysis	4		4	40	60	100
4	CESE 1004	Advanced Theory and Design of RCC Structures	4		4	40	60	100
5	CESE 1005	Elective – I	3		3	40	60	100
6	CESE 1006	Elective – II	3		3	40	60	100
7	CESE 1051	Concrete Lab		3	2	40	60	100
8	CESE 1052	Computer Aided Design Lab		3	2	40	60	100
9		Self Learning Course			2	40	60	100

L: Lecture **T:** Tutorial **P:** Practical **C:** Credits
I: Internal Assessment **E:** End Examination **T:** Total Marks

Elective – I:

CESE 1005-1 Energy Efficient Buildings
CESE 1005-2 Advanced Concrete Technology
CESE 1005-3 Construction Management and Equipment
CESE 1005-4 Industry Oriented Subject

Elective – II:

CESE 1006-1 Composite Construction
CESE 1006-2 Fracture and Fatigue Analysis
CESE 1006-3 Prefabricated Structures
CESE 1006-4 Sub-Structure Design

Self Learning Course:
Advanced Computational Techniques
Timber and formwork design
Repair and Rehabilitation

M.TECH – STRUCTURAL ENGINEERING
II Semester

S.No	Subject Code	Subject Title	T	P	C	I	E	T
1	CESE 2001	Finite Element Analysis of Structures	4		4	40	60	100
2	CESE 2002	Stability of Structures	4		4	40	60	100
3	CESE 2003	Design of Steel Structures	4		4	40	60	100
4	CESE 2004	Earthquake Resistant Design of Structures	4		4	40	60	100
5	CESE 2005	Elective III	3		3	40	60	100
6	CESE 2006	Elective IV	3		3	40	60	100
7	CESE 2051	Structural Engineering Lab		3	2	40	60	100
8	CESE 2052	Computer Aided Project Management		3	2	40	60	100
		Seminar/Design Project			2	40	60	100

L: Lecture **T:** Tutorial **P:** Practical **C:** Credits
I : Internal Assessment **E:** End Examination **T:** Total Marks

Elective – III:
CESE 2005-1 Design of Prestressed Concrete Structures
CESE 2005-2 Shell Structures and Folded Plates
CESE 2005-3 Structural Optimization
CESE 2005-4 Industry Oriented Subject

Elective – IV:
CESE 2006-1 Design of Tall Structures
CESE 2006-2 Structural Health Monitoring
CESE 2006-3 Advanced Bridge Engineering
CESE 2006-4 Design of Industrial Structures

M.TECH – STRUCTURAL ENGINEERING
III Semester

S.No	Subject Code	Subject Title	Credits	Maximum Marks (Internal)
1	CESE 3051	Project Work (Stage – A)	8	100*

* Continuous Evaluation → 40 Marks
End Semester Examination → 60 Marks

M.TECH – STRUCTURAL ENGINEERING
IV Semester

S.No	Subject Code	Subject Title	Credits	Maximum Marks (Internal)	Maximum Marks (External)
1	CESE 4051	Project Work (Stage – B)	16	100*	100

* Continuous Evaluation → 40 Marks
End Semester Examination → 60 Marks

CESE 1001 THEORY OF ELASTICITY AND PLATES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Solve problems using elasticity principles
	CO2 Obtain solution by using polynomials and general equations of Elasticity
	CO3 Analyze long rectangular thin plates for cylindrical bending using Elasticity principles and applying mathematical principles for solution of differential equations
	CO4 Analyze the laterally loaded rectangular plates for small deflections using elasticity principles by various theories proposed by Navier and Levy
Course Content	**UNIT-I** Introduction – Various Coordinate systems – Assumptions in linear Elasticity – Principal Stresses – Cauchy's stress function – Octahedral Stresses -Equilibrium Equations for both Cartesian and polar Coordinates – Stress strain relations – Generalized Hooks law – Plane stress – Plane Strain - Governing differential Equation for plane problems in Cartesian and polar coordinates **UNIT-II** Determination of stresses – Solution by polynomials – Saint Venant's Principle - Airy's stress function – Determination of displacements and stresses for Cantilever beam loaded at free end – Simply supported beam with UDL – Stresses on a Elliptical section – Effect of Circular holes on stress distribution in plates **UNIT-III** **Introduction to plates** - Differential equation for cylindrical bending of plates - Cylindrical bending of uniformly loaded rectangular plates with simply supported edges; Cylindrical bending of uniformly loaded rectangular plates with clamped edges. **Pure bending of plates** - Slope and curvature of slightly bent plates; Relations between bending moments and curvature in pure bending of plates; Particular cases of pure bending; Strain energy in pure bending of plates; Limitation on the application of the derived Formulae. **UNIT-IV** **Symmetrical bending of circular plates** - Differential equation for

	symmetrical bending of laterally loaded circular plates; Uniformly loaded circular plates; Circular plate loaded at centre. **Small deflections of laterally loaded plates** - Differential equation of the deflection surface; Boundary conditions; Simply supported rectangular plates under sinusoidal load; Navier's solution for simply supported rectangular plates; Further applications of the Navier's solution; Levy's solution for simply supported and uniformly loaded rectangular plates; Concentrated load on a simply supported rectangular plate
Text books and Reference books	**Text Book:** 1. Theory of elasticity by S.P.Timoshenko & J.N.Goodier, McGraw-Hill,1970. 2. Theory of elasticity by Sadhu Singh – Khanna publishers 3. Theory of plates and shells by S.P.Timoshenko and S.Woinowsky-Krieger, McGraw-Hill, 1959. 4. Stresses in plates and shells by A.C.Ugural, McGraw-Hill, 1999. 5. Analysis of plates by T.K.Varadan and K.Bhaskar, Narosa Publishing House, 1999. **Reference Books:** 1. Mechanics of Engineering Materials by P.P. Benham & R.J. Crawford.
E-resources and other digital material	http://www.nptel.ac.in/courses/105108070/ Theory of Elasticity - Nptel http://nptel.ac.in/video.php?subjectId=112101095 Theory of Elasticity and Plates – Nptel (video)

CESE 1002 DYNAMICS OF STRCUTURES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Write Equations of motion for analyzing dynamic response of SDOF, MDOF systems and understand the concept of response spectrum technique to SDOF systems.
	CO2 Understand earthquake response of structures and apply earthquake code requirements in design of structural systems.
	CO3 Understand equations of motions for MDOF structures with multi-storied buildings as the examples, and free and forced vibration response analysis of multi-storied buildings and systems with distributed mass.
	CO4 Understand simplified analysis of MDOF systems using the concept of generalized SDOF systems by applying Orthogonality and normal co-ordinate system
Course Content	**UNIT-I** **Introduction to Structural Dynamics:** Fundamental objectives of dynamic analysis- types of prescribed loading- Formulation of equations of motion by different methods-direct equilibration using Newton's Law of motion/ D'Alembert's principle, principle of virtual work and Hamilton principle. **Single Degree of Freedom Systems:** Formulation and solution of the equation of motion-Free vibration of SDOF systems- Undamped and damped vibrations, critical damping, logarithmic decrement, Forced vibration of SDOF systems – response to harmonic, periodic, impulsive and general dynamic loadings, Duhamel's integral; Numerical evaluation of dynamic response Newmark's method **UNIT-II** **Multi Degree of Freedom Systems:** Selection of single degree of Freedom- Evaluation of structural property matrices- Formulation of the MDOF equations of motions-Undamped Free vibrations- Solutions of Eigen value problem for natural frequencies and mode shapes- Analysis of dynamic

	response-Normal co-ordinates – Uncoupled equations of motion-orthogonal properties of normal modes- Mode superposition procedure- Review of time history and spectrum methods of analysis **UNIT-III** **Approximate methods of Computing Natural Frequencies** Rayleigh's method- Dunkerley's method – Methods of Iteration: Stodola- Vainello method- Rayleigh-Ritz method. **Continuous Systems** Introduction- Flexural Vibrations of beams-Elementary case-derivation of governing differential equation of motion- analysis of undamped free vibrations of beams in flexure- Natural frequencies and mode shapes of simple beams with different end conditions-Principles of application to continuous beams **UNIT-IV** **Introduction to Earthquake Response of Structures** Introduction- response of single degree of freedom system to earthquake excitation- Response spectra; Response of MDOF systems to Earthquake excitations; Discussions on IS 1893-2002 Codal provisions for building structures- I.S.Code methods of analysis for obtaining response of multi storied buildings.
Text books and Reference books	**Text Book:** 1. Dynamics of Structures: Theory and application to Earthquake Engineering by A.K.Chopra , Prentice-Hall of India, 2001. 2. Dynamics of Structures by R.W. Clough and P.E. Penzien , McGraw-Hill, 1993. 3. Structural Dynamics: Theory and Computation by Mario Paz, Kluwer Academic Publishers , 2003. **Reference Books:** 1. Theory of Vibration An Introduction by A.A.Shabana, Springer International Edition, 2010 2. Dynamics of Structures by J L Humar, Prentice-Hall 2. Structural Dynamics An Introduction to Computer Methods by Roy R. Craig.Jr., JOHN WILEY & SONS, Inc.,
E-resources and other digital material	http://nptel.ac.in/courses/105101006/ Structural Dynamics

CESE 1003 MATRIX METHODS OF STRUCTURAL ANALYSIS

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Solve the problems by flexibility matrix method
	CO2 Solve the problems by stiffness matrix method
	CO3 Analyse framed structures by using computer software
	CO4 Learn analysis of framed structures by use of computer program.
Course Content	**UNIT-I** **Fundamentals of the Flexibility Method:** Introduction; Flexibility Method; Temperature changes; Prestrains and Support Displacements; Joint Displacements; Member End Actions and support reactions; Flexibilities of prismatic members; Formalization of the Flexibility method. **UNIT-II** **Fundamentals of the Stiffness Method:** Introduction; Stiffness Method; Temperature changes; Prestrains and Support Displacements; Stiffness of Prismatic Members; Formalization of the Stiffness Method. **UNIT-III** **Computer Oriented Direct Stiffness Method:** Introduction; Direct Stiffness Method; Complete Member Stiffness Matrices; Formation of Joint Stiffness Matrix; Formation of Load Vector; Rearrangement of Stiffness and Load Arrays; Calculation of Results; Analysis of Continuous Beams; Grid member stiffness's – Analysis of grids Plane Truss Member Stiffness; Analysis of Plane Trusses; Rotation of Axes in Two Dimensions; Application to Plane Truss Members; Rotation of Axes in Three Dimensions; Plane Frame Member Stiffness; Analysis of Plane Frames. **UNIT-IV** **Computer Programs for Framed Structures**: Flow Chart for the analysis of the following structures: • Continuous Beam • Plane Truss • Plane Frame Miscellaneous: Analysis of large structures; The sub structuring technique – truss problem – Computer program for the truss analysis by the

	substructure technique Static condensation procedure; Non – prismatic and curved members.
Text books and Reference books	**Text Book:** 1. Matrix Analysis of Framed Structures by W. Weaver & J.M.Gere, CBS Publishers, 1986. 2. Matrix and finite element analyses of structures by M.Mukhopadhay and A.H.Sheikh, Ane Books, 2004. 3. Matrix Methods of Structural Analysis: Theory and Problems by C. Natarajan & P. Revathi **Reference Books:** 1. Computational structural mechanics by S.Rajasekharan and G. Sankarasubramanian, Prentice Hall of India, 2001. 2. Basic Structural Analysis by C.S. Reddy, Tata McGraw-Hill Publications **3.** Structural Analysis, A Matrix Approach by G Pandit and S. Gupta
E-resources and other digital material	http://nptel.ac.in/courses/105106050/ Advanced Structural Analysis

CESE 1004 ADVANCED THEORY AND DESIGN OF RCC STRUCTURES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand and design of deep beams and shear walls
	CO2 Understand and design of flat slabs using Equivalent frame method.
	CO3 Understand the analysis and design of reinforced concrete beams under fire, other considerations
	CO4 Understand the design of statically indeterminate RC structures and ductile detailing of RC members.
Course Content	**UNIT-I** **Reinforced concrete deep beams** Introduction; Minimum thickness; Steps of designing of deep beams; Design by IS456; Checking for local failures; Detailing of deep beams. **Design of shear walls** Introduction; Classification of shear walls; Classification according to behavior; Loads on shear walls; Design of rectangular and flanged shear walls. **UNIT-II** **Flat Slabs** Shear in flat slabs and flat plates – One-way shear, Two-way (punching) shear, Shear due to unbalanced moment, Shear reinforcement design; Equivalent frame analysis of flat slabs – Historical development and definition of equivalent frame, Moment of inertia of slab-beams, Theoretical column stiffness's, Use of published data for flat slabs, equivalent column method, arrangement of live load, Reduction in negative moments, Design procedure. **UNIT-III** **Design of Reinforced Concrete Members for Fire Resistance:** Introduction, ISO 834 Standard heating conditions, grading or classifications, effect of high temperature on steel and concrete, effect of high temperature on different types of structural members, fire resistance by structural detailing from tabulated data, analytical determination of the ultimate bending moment, capacity of reinforced concrete beams under fire, other considerations

	UNIT-IV **Design of statically indeterminate RC structures** Development of moment curvature diagrams; Moment redistribution in RC structures; Baker's method of design; Ductility of RC members; Confined concrete; Cambridge method of design ; Generation of load-deflection diagrams, Detailing: General layout of reinforcement, Beam-Column joints, Beam to girder joints.
Text books and Reference books	**Text Book:** 1. Advanced reinforced concrete design by P.C.Varghese, Prentice-Hall of India, 2005. 2. Reinforced concrete structural elements by P.Purushothaman, Tata McGraw-Hill, 1984. 3. Reinforced concrete design by S.U. Pillai and D.Menon, Tata McGraw-Hill, 2003. **Reference Books:** 1. Design of concrete structures by A.H.Nilson, McGraw-Hill, 1997. 2. Reinforced concrete structures by R.Park and T.Paulay, John Wiley & Sons, 1975. 3. Reinforce and Pre-stressed concrete structures by Kong and Evans, ELBS,1995
E-resources and other digital material	

CESE 1005/1 ENERGY EFFICIENT BUILDINGS

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand basics of energy conservation concepts in buildings
	CO2 Apply various green building materials and methods for energy efficient buildings
	CO3 Understand basics of sanitary provisions in green buildings
	CO4 Study the environmental impact in energy efficient buildings
Course Content	**UNIT-I** Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design. Renewable Energy sources that can be used in Green Buildings – Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewables. A passive solar strategy, Photovoltaics, Climate and Energy, Macro and Microclimate. Indian Examples. **UNIT-II** Building Form – Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, Grouping of buildings. Building Fabrics- Windows and doors, Floors, Walls, Masonry, Ecological walling systems, Thermal Properties of construction material. **UNIT-III** Infiltration and ventilation, Natural ventilation in commercial buildings, passive cooling, modeling air flow and ventilation, Concepts of daylight factors and day lighting, daylight assessment, artificial lighting, New light sources. Cooling buildings, passive cooling, mechanical cooling. Water conservation- taps, toilets and urinals, novel systems, collection and utilization of rainwater. **UNIT-IV** Energy awareness, monitoring energy consumption, Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED). Ecohomes, Sustainable

	architecture and urban design – principles of environmental architecture. IGBC – Indian green Building Code, Benefits of green buildings – Energy Conservation Building code - NBC -Case Studies – Green Buildings in Auroville and Dakshina Chitra, Tamil Nadu, India.
Text books and Reference books	**Text Book:** 1. William T. Meyer., Energy Economics and Building Design., New York: McGraw-Hill, Inc **Reference Books:** 1. Public Technology, Inc. (1996). Sustainable Building Technical Manual: Green Building Design, Construction, and Operations. Public Technology, Inc., Washington, DC. 2. Sim Van Der Ryn, Stuart Cowan, "Ecological Design", Island Press (1996). 3. Dianna Lopez Barnett, William D. Browning ,"A Primer on Sustainable Building", Rocky Mountain Green Development Services,. 4. The HOK Guidebook to Sustainable Design, Sara Mendler and William Odell, John Wiley. 5. David A. Gottfried, Sustainable Building Technical Manual., Public Technology Inc 6. Richard D. Rush, . Building System Integration Handbook., New York: John Wiley & Sons 7. Ben Farmer & Hentie Louw., Companion t**o** Contemporary Architectural Thought, London & New York: Routledge 8. Peter Noever (ed)., Architecture in Transition: Between Deconstruction and New Modernism., Munich: Prestel.
E-resources and other digital material	

CESE 1005/2 ADVANCED CONCRETE TECHNOLOGY

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Know the application of different admixtures & additives and do a mix design by different methods.
	CO2 Get a thorough knowledge of various types of cement, aggregates and properties of special concrete and test the concrete with different procedures.
	CO3 Get knowledge on fibres and their usage in concrete and do the mix design of FRC using different fibres.
	CO4 Understand interaction, bonding and behaviour of FRC.
Course Content	**UNIT-I** Materials – Concrete materials – Reinforcements, admixtures and additives. Mix design – Specifications – Design of concrete mixes by IS code method, ACI method. High strength concrete. Behaviour of concrete – Modern trends in concrete manufacture and placement techniques – theological behaviour of fresh concrete and hardened concrete – Resistance to static and dynamic loads. **UNIT-II** Testing of concrete – Non-destructive testing and quality control – Durability – Corrosion protection and fire resistant. Special Concrete – Pre-cast concrete – Light weight concrete – Under water concrete – Pump concrete – Polymer concrete – Composite concrete. **UNIT-III** Types of fibres and their mechanical properties: Metallic fibres; Polymeric fibres; Carbon fibres; Glass fibres. Properties of constituent materials; Mix proportions; mixing and casting methods; Properties of freshly mixed FRC; Workability tests; Tests for air content; Yield and unit weight; Steel fibre-reinforced concrete; Polymeric fibre- reinforced concrete; Other fibres. **UNIT-IV** Fibre materials distribution and orientation; Interfacial bond and properties in fresh state; Mechanism of fibre contribution to

	bending; Flexural toughness; Prediction of load deflection response. Crack propagation; applications of fibre reinforced concretes.
Text books and Reference books	**Text Book:** **1.** Shetty. M.S. (2002), Concrete Technology, S.Chand & Company Ltd. **2.** Santha Kumar, A.R., (2007), Concrete Technology, Oxford University Press. **Reference Books:** 1. Neville, A.M. (2003), Properties of Concrete, Standard Publishers Distributors. 2. Varshney (2000), Concrete Technology, Khanna Publishers, New Delhi. 3. IS: 383 – 1970, (2005), Specification for Coarse and fine natural sources for Concrete, 4. BIS, New Delhi. 5. IS: 9103-1979, (2005), Specification for Admixtures for Concrete, BIS, New Delhi.
E-resources and other digital material	www.http://nptel.ac.in/courses/105102012/ www.http://nptel.ac.in/courses/105104030/14

CESE 1005/3 CONSTRUCTION MANAGEMENT AND EQUIPMENT

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand various construction works and equipments
	CO2 Attain knowledge on risk management and on appropriate safety measures
	CO3 Understands concepts of quality, value engineering and human factors in construction
	CO4 Attain knowledge on role of Information technology relating to the civil engineering.
Course Content	**UNIT-I** **Introduction** Classification of construction works; Various stages in the construction of a project. **Construction equipment** Introduction; Classification of construction equipment; Earthmoving equipment; Hauling equipment; Hoisting equipment; Conveying equipment; Aggregate and concrete production equipment; Pile driving equipment; Tunneling and drilling equipment; Pumping and dewatering equipment. **Management of Construction** Introduction; Management requirement; Need for mechanization; Financial aspects of construction plants and equipment; Factors affecting selection of construction equipment; Planning of construction equipment; Factors affecting the cost of owning and operating construction equipment; Planning of infrastructure for mechanization; Role of operations research; Equipment management. **UNIT-II** **Risk Management** Certainty, risk and uncertainty, risk management, identification and nature of construction risks, types of risks, minimizing risks and mitigating losses. **Construction Safety Management**

E-resources and other digital material	http://www.nptel.ac.in/courses/105103093/
	Prevention of fires at construction sites, Fault Tree Analysis. **UNIT-III** **Quality control in construction** Importance of quality; Elements of quality- quality characteristics, design quality, quality of conformance; Organization for quality control; Quality assurance techniques-Inspection, Testing, Sampling; Documentation; Quality control circles. **Human Factors in Construction** Qualities of efficient construction managers; Personality; Ethics and integrity; Personal drive; Multi-disciplinary capability; Human relations **Value Engineering** Definition of value engineering; Value engineering job plan; Life cycle costing; Value engineering Applications **UNIT-IV** **Management Information Systems** Introduction; Definition of organization; Definition of management; Definition of management information system; Computer as information system; Use of computer in construction industry; Requirements of management information system; A data base approach; Salient features of some software packages used in construction industry. **Information Technology in Construction Industry** Introduction; Information flow and communication; Knowledge data base; Learning organization attributes; Use of information technology in construction industry; Role of artificial intelligence and expert systems.
Text books and Reference books	**Text Book:** 1. Construction Engineering and Management by S.Seetharaman, Umesh Publications, 2003. **Reference Books:** 1. Construction planning, Equipment and methods by R.L.Peurifoy, C.J.Schexnayder and Aviad Shaptra, McGraw-Hill, 2005. 2. Construction management by D.W.Halpin, Publisher : Wiley, 2005. 3. Project management in construction by S.M.Levy, McGraw-Hill Professional, 2006. 4. Total construction project management by G.J.Ritz, McGraw-Hill Professional, 1993. 5. Construction management fundamentals by C.J.Schexnayder and R.Mayo, McGraw-Hill Science Engg. Math, 2003.

CESE 1006/1 COMPOSITE CONSTRUCTION

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand the steel composite construction
	CO2 Understand the column design, combined compression, uni-axial and bi-axial bending
	CO3 Understand the design equation for flexure, analysis of continuous beams and bottom flange stability
	CO4 Understand the advantages of composite floors, bending, shear resistance of composite slab and connections in composite construction
Course Content	**UNIT-I** **Introduction** Composite beams and slabs, composite columns and frames, Steel-concrete composite construction; Economics of Steel-concrete composite construction – CBRI (India), British experience (Design philosophy and Eurocodes), properties of materials, **Theory of composite structures** Objectives; Methods of analysis and design of composite sections; Composite action; Failure modes; Creep and shrinkage **UNIT-II** **Composite beams - I** Introduction; Elastic behaviour of composite beams; Shear connectors; Ultimate load behaviour of composite beam; Serviceability limit states **Composite columns** Introduction; Composite columns, Beam to column joints – Properties of joints, classification of joints, Materials; Composite column design; Design method; Combined compression and uniaxial bending; Combined compression and biaxial bending; Steps in design; Design examples **UNIT-III** **Composite beams – II** Introduction; Applications of composite beam; Basic design considerations; Design application – Design equation for flexure, design using profile sheeting supported on steel beams, effect of

	degree of shear connection, Interaction between shear and moment, Serviceability; Effect of continuity- Analysis of continuous beams, Bottom flange stability, defection; Design of simply supported composite beam; Design of continuous composite beam **UNIT-IV** **Composite floors and slabs** Simply supported composite slabs: Layout, Materials and loadings, Advantages of composite floors; Composite slabs, Structural elements; Bending resistance of composite slab; Shear resistance of composite slab; Serviceability criteria; Design considerations; Serviceability limit states, Continuous composite slabs, **Connections in composite construction** Introduction; Ultimate strength of plastic region
Text books and Reference books	**Text Book:** 1. Workshop material on Steel-concrete composite structures, Sponsored by INSDAG, Kolkata. 2. Composite construction using structural steel, INSDAG Publication, Kolkata **Reference Books:** 1. Handbook on composite construction – Multistorey buildings, INSDAG Publication, Kolkata. 2. Teaching resource for structural steel design, Vol. 2, INSDAG Publication, Kolkata 3. Composite structures of steel and concrete, Vol. 1, Blackwell Scientific Publications, UK, 1994.
E-resources and other digital material	

CESE 1006/2 FRACTURE AND FATIGUE ANALYSIS

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand the concept of fatigue and various failures related to fatigue
	CO2 Apply fatigue to materials and models
	CO3 Explain Principles of linear and non linear elastic fracture mechanics
	CO4 Explain fracture process of concrete
Course Content	**UNIT-I** Types of fatigue loading and failure, Fatigue test, endurance limit, S-N diagram; Various failure relations, Viz., Soderberg, Modified Goodman - Gerber parabolic-, Elliptical-relations; Factors influencing fatigue strength; Influence of stress concentration on fatigue test; Fretting corrosion; Effect of environment-corrosion fatigue; Increased fatigue life due to surface protection. **UNIT-II** Forms of stress cycle – Test methods – Fatigue data – Micro mechanisms of fatigue: Initiation and propagation – Fracture mechanics for fatigue – Influential factors – Cumulative damage – Failure under multiaxial cyclic stresses – Fatigue of plastics and composites **UNIT-III** Structural failure based on material performance – concepts of linear elastic fracture mechanics – Crack growth and fracture mechanisms – Stress intensity factor – Crack mouth opening displacement – Crack tip opening displacement – Energy release rate – Resistance – Griffith Theory of fracture – Extension of Griffith Theory by Irwin and Orowan – R-Curve – Westergaard Solutions – Plastic zone – Irwin and Dugdale models – Fracture toughness testing – Evaluation of crack growth constants – Paris law – J-Integral

	UNIT-IV Constituents and micro structure of concrete – Fracture behavior and strain localization of concrete – Fracture process zone and toughening mechanisms – Influence of fracture process zone on fracture behavior of concrete – Effective elastic crack approach – Fictitious Crack Model – Tension Softening models – Fracture energy – Size effect
Text books and Reference books	**Text Book:** 1. D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, 1999. 2. Fracture Mechanics of Concrete: Applications of Fracture Mechanics to Concrete, Rock and Other Quasi Brittle Materials by Surendra P. Shah, Stuart E. Swartz, Chengsheng Ouyang, Publisher: Wiley, 1995 3. Fracture Mechanics – Applications to concrete, Edited by Victor C.Li and Z.P. Bazant, i. ACI SP118 4. Elements of fracture mechanics by Prashant Kumar, Wheeler Publishing 1999 **Reference Books:** 1. M.F. Kanninen and C.H. Popelar, Advanced Fracture Mechanics, Oxford Engineering Science Series, 1985. 2. T.L. Anderson, Fracture Mechanics – Fundamentals and Applications, CRC press, 1995. 3. C.T Suri and Jin Z.H, "Fracture Mechanics", 1st Edition, Elsevier Academic Press, 2012 4. David Broek, "Elementary Engineering Fracture Mechanics", 3rd Revised Edition, Springer, June 1982.
E-resources and other digital material	http://nptel.ac.in/courses/112106065/

CESE 1006/3 PREFABRICATED STRUCTURES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Text books and Reference books	**Text Book:** 1. CBRI, Building materials and components, India, 1990 2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., "Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994 **Reference Books:** 1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976. 2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009
E-resources and other digital material	http://civildigital.com/prefabricated-structures-prefabrication-concept-components-advantages-ppt/
	Construction of roof and floor slabs – Wall panels – Columns – Shear walls **UNIT-III** **Design principles** Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation. **Joints in structural members** Joints for different structural connections – Dimensions and detailing – Design of expansion joints **UNIT-IV** **Design for abnormal loads** Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., Importance of avoidance of progressive collapse.

CESE 1006/4 SUB STRUCTURE DESIGN

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand, analyze and design various types of Shallow Foundations and their settlement with special reference to Raft Foundation
	CO2 Understand, analyze and design Deep foundations such as Pile Foundation and Well Foundation
	CO3 Develops the ability to understand and analyze Soil Dynamics, theory of vibration and Machines and Foundations for the machines
	CO4 Understand, analyze and design structures incorporating earthquake loads with special reference to Liquefaction of soils
Course Content	**UNIT-I** **Shallow Foundations** Effect of eccentric loading, inclined load, inclination of base of foundation, sloping ground; Bearing Capacity of stratified soils; Meyerhof analysis, Vesic's analysis and Hansen's analysis – Types of Rafts – Design of Rafts. **Settlement analysis** Contact pressure, sources of settlement, uniform settlement, differential settlement, construction practices to avoid differential settlement, allowable bearing pressure of sands from SPT, immediate settlement in sands and clays- Terzaghi and Janbu's methods for clays , Schmertmann and Hartman method for cohesion-less soils; consolidation settlement. **UNIT-II** **Pile Foundations** Carrying capacity of a single pile; Static and Dynamic methods; Pile load test; Pile groups; Group efficiency; Design of pile groups; Laterally loaded piles; Battered piles; Eccentric loads; Settlement of single pile and pile groups; R.C.C. design of pile and pile caps; Under reamed piles. **Well Foundations** Method of construction of piers; Open wells and Pneumatic Caissons; Design of pier foundations and well foundations; Lateral stability of well foundations; R.C.C. designs of wells **UNIT-III** **Machine Foundation**

	Fundamentals of Vibration; Free and Forced Vibration with and without damping; Natural frequency of foundation; Soil system; Dynamic soil properties; Vibration Isolation; Types of machines and machine foundation; I.S. Code of practice for design and construction of block foundation for reciprocating and impact type machines and framed foundations for high speed rotary machines. **UNIT-IV** **Geotechnical Earthquake Engineering** Effect of type soil on the response spectrum; Liquefaction – Definition and types, Effect of liquefaction on built environment, Evaluation of liquefaction susceptibility, liquefaction hazard mitigation; Seismic slope stability – Introduction, Pseudo-static analysis, sliding block method.
Text books and Reference books	**Text Book:** 1. Soil dynamics and Machine Foundations by Swami Saran, Galgotia Publications Pvt. Ltd., New Delhi. 2. Pile Foundations in Engineering Practice, Shamsher Prakash & Hari D. Sharma 3. Foundation Analysis & Design by Bowles, J.E., McGraw-Hill Book Company **Reference Books:** 1. Hand book of machine foundations by Sreenivasulu, P & Vaidyanathan,C.V 2. Geotechnical Earthquake Engineering by Steven L. Kramer, Pearson Education 3. Basic and Applied Soil Mechanics by Gopal Ranjan and ASR Rao, Wiley Eastern Limited, New Delhi. 4. Geotechnical Engineering by SK Gulati & Manoj Datta, Tata McGraw- Hill Publishing Company Limited
E-resources and other digital material	1. http://nptel.ac.in/courses/105101083/ Foundation Engineering - Dr. Deepankar Choudhury, IIT Bombay 2. http://nptel.ac.in/courses/105105039/ Advanced Foundation Engineering - Dr. Kousik Deb, IIT Kharagpur 3. http://nptel.ac.in/courses/105108069/ Advanced Foundation Engineering - Dr. T.G. Sitharam, IISc Bangalore

CESE 1051 CONCRETE LABORATORY

Course Category:	Programme Elective	**Credits:**	2
Course Type:	Lab	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Design the mix for various grades of concrete
	CO2 Assess the strength and workability of concrete
	CO3 Study the influence of various admixtures on concrete
	CO4 Identify the effects of various parameters on Strength of concrete
	CO5 Know the application of various NDT techniques on concrete structures
Course Content	1. Study of the effect of water cement ratio on workability and strength of Concrete. 2. Study of the effect of aggregate cement ratio on Workability and strength of concrete 3. Study on properties of cement and aggregate for Mix design 4. Mix design methods using a. I.S. Code method b. ACI Code method 5. Influence of Different Chemical Admixtures on concrete 6. A study on of correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture based on IS Method 7. A study of behaviour of under-reinforced and over-reinforced beams 8. A study on the effect of span to depth ratio on the failure pattern of RC beams 9. Study of Non-Destructive Testing Methods on Concrete

CESE 1052 COMPUTER AIDED DESIGN LABORATORY

Course Category:	Programme Elective	**Credits:**	2
Course Type:	Lab	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Analyze and design the structural components like beams, slabs, columns, retaining wall and shear wall.
	CO2 Perform earthquake analysis & wind analysis for framed buildings.
	CO3 Analyze and design pin jointed, rigid jointed plane structures.
	CO4 Perform free vibration analysis of a shear building and time history analysis.
	CO5 Analyze beams, trusses and plates using ANSYS.
Course Content	

GROUP A	1. Design of reinforced concrete beam (singly/doubly) 2. Design of reinforced concrete deep beam 3. Design of reinforced concrete column subjected to biaxial bending 4. Design of reinforced concrete slab (One-way/Two-way) 5. Design of reinforced concrete retaining wall (cantilever type) 6. Design of reinforced concrete shear wall
GROUP B	1. Lateral forces on a building due to an earthquake using equivalent static method 2. Lateral forces on a building due to wind 3. Free vibration analysis of a shear building 4. Time-history analysis of single degree of freedom system subjected horizontal ground motion
GROUP C	1. Analysis of pin jointed plane trusses 2. Analysis of rigid jointed plane frames 3. Analysis of simply supported/cantilever beam 4. Analysis of plane truss 5. Analysis of plate with circular hole

Note: Any 10 of the above problems are to be solved using Computer programs / Application software's like Staad.Pro/ETABS/SAP and ANSYS.

	Note: Students must do at least 3 experiments from each group (A,B,C) subject to a minimum of 10 experiments.

CE 2001 FINITE ELEMENT ANALYSIS OF STRUCTURES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand Classification of problems as 1-D, 2-D and 3-D based on the system
	CO2 Apply governing principles for formulation of Element stiffness matrices & Load vectors
	CO3 Understand the Fundamental Concepts of Displacement based approach and Iso-parametric based Finite Element Approach
	CO4 Analyze trusses, beams, Plates and shells using FEM
Course Content	**UNIT-I** **Basic Principles** Equilibrium equations; Strain-displacement relations; linear constitutive relations; **Formulation techniques**: Variational methods & Weighted residual methods: Principle of stationary potential energy-Problems having many degrees of freedom-The Rayleigh Ritz method-Finite element form of the Rayleigh Ritz method, Convergence of finite element solutions. Galerkin and other weighted residual methods: Galerkin method- Methods of weighted residuals-Galerkin finite element method in one dimension- Integration by parts – Galerkin finite element method in two dimensions- A mixed formulation **UNIT-II** **Element Properties** Preliminaries – Interpolation and shape functions – Formulas for element matrices – linear triangle (CST) – Quadratic triangle (LST) – Bilinear rectangle – Quadratic rectangle – Rectangular solid elements – Choice of interpolation function – Nodal loads – Stress calculation – Nature of finite element solution. **Isoparametric Elements:** Introduction – Bilinear quadrilateral – Quadratic quadrilaterals – hexahedral isoparametric elements – Incompatible Modes – Static condensation – Numerical integration – Load considerations – Stress calculation – Validity of Isoparametric elements – Patch test. Isoparametric triangles and tetrahedron: Reference coordinates, shape functions, Element characteristic matrices, Analytical

	integration, Area and Volume coordinates Numerical integration. **UNIT-III** **Plane-stress and Plane-strain analysis** Solving plane stress and plane-strain problems using constant strain triangle and four nodded isoparametric element **Analysis of plate bending** Basic theory of plate bending; Shear deformation plates; Plate bending analysis using four noded iso-parametric element. **UNIT-IV** **Analysis of shells** Degenerated shell elements – Evaluation of element stiffness matrix and load vector for eight noded iso-parametric shell element.
Text books and Reference books	**Text Book:** 1. Finite element analysis by C.S.Krishnamurthy, Tata-McGraw-Hill, 1994. 2. Matrix and finite element analyses of structures by M.Mukhopadhay and A.H.Sheikh, Ane Books, 2004. 3. Concepts and applications of finite element analysis by R.D.Cook et.al., John Wiley and Sons, 1989. **Reference Books:** 1. Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla & Ashok D. Belegundu 2. Text book of Finite Element Analysis by P. Seshu 3. Finite Element Analysis in Engineering and Design by S. Rajasekaran 4. Introduction to the Finite Element Method: A Numerical For Engineering Analysis by Chandrakant S. Desai, John Fedrick Abel
E-resources and other digital material	http://nptel.ac.in/courses/105105041/

CESE 2002 STABILITY OF STRUCTURES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1: Understand the buckling of columns, beams and find critical loads using energy and non-energy methods
	CO2: Understand the buckling of rectangular plates and find critical compressive loads of simply supported plates with various edge conditions
	CO3: Understand the buckling of axially loaded cylindrical shells
	CO4: Understand and apply finite element method for buckling problems.
Course Content	**UNIT-I** **Buckling of columns:** Introduction; Methods of finding critical loads; Critical loads for straight columns with different end conditions and loading; Inelastic buckling of axially loaded columns; Energy methods; Prismatic and non-prismatic columns under discrete and distributed loading; General Principles of elastic stability of framed structures. **Beam Columns** – Theory of Beam column – Stability analysis of beam column with Different types of loads – Failure of beam columns **UNIT-II** **Lateral Buckling of Beams:** Beams under pure bending; Cantilever and simply supported beams of rectangular and I sections; Beams under transverse loading; Energy methods; Solution of simple problems. **UNIT-III** **Buckling of Rectangular Plates:** Plates simply supported on all edges and subjected to constant compression in one or two directions; Plates simply supported along two opposite sides perpendicular to the direction of compression and having various edge conditions along the other two sides **UNIT-IV** **Buckling of Shells:** Introduction to buckling of axially compressed cylindrical shells. Mathematical treatment of stability problems-Discrete/Discontinuous systems; Eigen value problem; converting continuous systems to discrete systems using the finite element

	method – Buckling of a column with sudden change in cross-section
Text books and Reference books	**Text Book:** 1. Theory of elastic stability by Timoshenko & Gere, McGraw Hill, 1961. 2. Background to buckling by Allen and Bulson, McGraw-Hill, 1980. 3. Elastic stability of structural elements by N.G.R.Iyengar, Macmillan India Ltd., 2007. **Reference Books:** 1. Principles of Structural stability theory by Alexandar Chajes
E-resources and other digital material	

CESE 2003 DESIGN OF STEEL STRUCTURES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1: Analyse wind loads on industrial buildings and design of braced industrial buildings
	CO2: Analyse and design of Unbraced industrial buildings
	CO3: Analyse and design of towers
	CO4: Understand & design of connections
Course Content	**UNIT-I** **Wind Loads On Buildings** Introduction to wind load; Design wind speed and pressure; Wind pressure on roofs; Wind effect on cladding and louvers; Design of purlins for roofs and rails for cladding; Open sheds – Pitched roofs **Braced Industrial Buildings** Introduction; Design of braced small industrial building with gantry **UNIT-II** **Unbraced Industrial Buildings** Introduction; Rigid frames; rigid frame knees; Gable frames; Design of a simple Gable frame industrial building with gantry **UNIT-III** **Towers** Basic structural configurations - free standing and guyed towers towers - wind loads - foundation design - design criteria for different configurations and transmission line towers. **Connections** Bearing type joints - unstiffened and stiffened seat connections resisting connection of brackets-bolted and welded-semi-rigid connections **UNIT-IV** **Design Of Steel Truss Girder Bridges:** Types of truss bridges, component parts of a truss bridge, economic proportions of trusses, self weight of truss girders, design of bridge

	compression members, tension members; wind load on truss girder bridges; wind effect on top lateral bracing; bottom lateral bracing; portal bracing; sway bracing
Text books and Reference books	**Text Book:** 2. Design of steel structures by N.Subramanian ,oxford university press 3. Design of steel structures by B. Bresler, T.Y.Lin and J.B.Scalzi, John Wiley & Sons, 1968 4. Limit state design of steel structures by S.K.Duggal 5. IS 800-2007 Indian Standard General Construction In Steel — Code Of Practice (Third Revision) **Reference Books:** 1. Steel structures: Design and behaviour by C.G.Salmon and J.E.Johnson, Prentice-Hall, 1997 **2.** Structural steel design by P.J.Dowling, P.R.Knowles and G.W.Owens, Publisher Butterworths, London, 1998.
E-resources and other digital material	

CESE 2004 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lectures**	4 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1: Plan a good structural configuration for seismic resistance.
	CO2: Calculate the earthquake design forces using appropriate methods as per IS 1893-2002(Part-I).
	CO3: Apply the concept of Ductility and Base isolation in designing earthquake resistant structures.
	CO4: Design the structure using IS 13920 code provisions.
Course Content	**UNIT-I** **Seismo-resistant building architecture** Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/liquefaction. Foundations; Quality of construction and materials – quality of concrete, construction joints, general detailing requirements. **UNIT-II** **Design forces for buildings** Introduction; Equivalent static method; Mode superposition technique; Dynamic inelastic-time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as per IS1893(Part 1) – Equivalent static method, Model analysis using response spectrum, Estimate of deflection and drift, P-Δ Effects in frame structures, Torsional effects. **UNIT-III** **Ductility** Ductility relationships; Ductility considerations in earthquake resistant design of RCC buildings Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility–

	Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920-Aspects of detailing- Detailing of columns for ductility-Transverse reinforcement for confinement, spacing of column vertical reinforcement; Bond and anchorage-Development of bar strength, lapped splices, Additional considerations for anchorages. **Base isolation of structures** Introduction; Isolation from seismic motion, Considerations for seismic isolation-Seismic isolation using flexible bearings-Seismic isolation using flexible piles and energy dissipators; Basic elements of seismic isolation; seismic- isolation design principle; Feasibility of seismic isolation; Seismic isolation configurations. **UNIT-IV** **Earthquake resistant design of a long two-storey , two-bay RCC building** Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893 (Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member, typical column, footing and detailing of a exterior joint as per IS13920. **Seismic Evaluation and Retrofitting of structures** Seismic evaluation of structures or condition appraisal; Seismic Retrofitting.
Text books and Reference books	**Text Book:** 1. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006. 2. Seismic design of reinforced concrete and masonry buildings by T.Paulay and M.J.N.Priestley, John Wiley & Sons, 1991. **3.** Earthquake-Resistant Design of Building Structures by Dr. Vinod Hosur, WILEY, 2013. **Reference Books:** 1. Earthquake Resistant Design and Risk Reduction by David Dowrick, WILEY Student Edition, 2012. 2. Earthquake Resistant Design of Structures by S.K.Duggal, OXFORD Higher Education. 3. Elements of Earthquake Engineering by Jai Krishna & Brijesh Chandra, South Asian Publishers Private Limited, 2000.
E-resources and other digital material	http://nptel.ac.in/courses/105102016/

CESE 2005/1 DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Ability to analyse and design statically determinate and statically indeterminate members
	CO2 Ability to analyze and design the cylinder and non cylinder pipes and tanks
	CO3 Able to analyze and design the prestressed concrete slabs
	CO4 Able to analyse and design the poles, piles, sleepers, and shell roofs
Course Content	**UNIT-I** **Design of Pre-tensioned and Post-tensioned Flexural members** Difference between reinforced and pre-stressed concrete, Principles of pre-stressing – Classification of prestressed concrete structures – Materials – High strength concrete and High strength steel- Losses in pre-stress.Analysis of prestressed concrete (Pressure line ,load balancing concepts)Design of pretensioned beams; Design of post-tensioned beams **Statically indeterminate pre-stressed concrete structures** Design of continuous beams; Cable profile – Concordant cable and linear transformation .Sketching of pressure lines for continuous beams **UNIT-II** **Prestressed concrete pipes** Circular prestressing; Types of prestressed concrete pipes;Advantages of prestressed concrete pipes, Design of prestressed concrete pipes(cylinder,Non cylinder); **Prestressed concrete tanks** General features of prestressed concrete tanks; Analysis of prestressed concrete tanks; Design of circular pre-stressed concrete tanks. **UNIT-III** **Pre-stressed concrete poles, piles and Pre-stressed sleepers** Advantages of prestressed concrete poles , Shapes of prestressed concrete poles,Design of partially prestressed pretensioned poles, Advantages of prestressed concrete piles ,Types of prestressed

	concrete piles, Design of prestressed concrete piles,Types of prestressed concrete sleeperes; Design considerations of sleepers **Pre-stressed concrete slabs** Types of pre-stressed concrete floor slabs; Design of pre-stressed concrete one-way slabs; Design of pre-stressed concrete two-way slabs; Design of pre-stressed concrete simple flat slabs; Design of pre-stressed concrete continuous flat slab floors; **UNIT-IV** **Pre-stressed concrete piles and Pre-stressed sleepers** Advantages of prestressed concrete piles ,Types of prestressed concrete piles, Design of prestressed concrete piles,Types of prestressed concrete sleeperes;Design considerations of sleepers; **Pre-stressed concrete shells** Advantages of pre-stressing long span shell structures; Methods of pre-stressing shell structures; Design procedure of pre-stressed concrete shell structures; Design of pre-stressed concrete shell structures.
Text books and Reference books	**Text Book:** 1. Pre-stressed concrete by N.Krishna Raju, Tata-McGraw-Hill, 1995. 2. Pre-stressed concrete by N.Rajagopalan, Narosa Publishing House, 2005. 3. Pre-stressed concrete by T.Y.Lin & N.H.Burns, John Wiley & Sons,198 **Reference Books:**
E-resources and other digital material	

CESE 2005/2 SHELL STRUCTURES AND FOLDED PLATES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Text books and Reference books	**Text Book:** 5. Ramaswamy G.S. - "Design and Constructions of Concrete Shell Roofs" - CBS Publishers and Distributors - New Delhi – 1986 6. Bandhopadhyay J.N. "Thin shell Structures" - Classical and Modern Analysis" New Age International Publishers - New Delhi. 1986. **Reference Books:** 1. Chatterjee.B.K. - "Theory and Design of Concrete Shell", - Chapman & Hall, Newyork-third edition, 1988 2. Design of Reinforced Concrete Shells and Folded Plates by P.C. Varghese
E-resources and other digital material	http://www.nptel.ac.in/courses/105108127/
	UNIT-II **Design Of Shells With Double Curvature** Design of the following types of shells - Spherical shell - Conical shell - Parabolic and Ellipsoid - Cooling towers. **UNIT-III** **Design Of Cylindrical Shells** Design of cylindrical shell with edge beam using theory for long shells. **UNIT-IV** **Design Of Folded Plate Roofs** Assumptions in the analysis of folded plates - Design of folded plates - Theory of bending of thin plates with lateral loads and in plane loads - Scheme for de-shuttering.

2005/3 STRUCTURAL OPTIMIZATION

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Understand Optimization and Various techniques involved in Optimization
	CO2 Solve various linear and Non-linear problems
	CO3 Solve a problem by geometric programming and dynamic programming
	CO4 Understand various Non Traditional Optimization techniques and apply Optimization to structures
Course Content	**UNIT-I** **Introduction to Optimization** Statement of an Optimization problem, Classification Applications, Optimization literature **Classical Optimization Techniques** Single Variable Optimization, Multivariable Optimization with and without constraints, Kuhn-Tucker Conditions **UNIT-II** **Linear Programming** Graphical Method, Analytical Method, Two Phase Simplex Method, Z_j-C_j Method, Primal Dual Algorithm, Big M Method. **Non Linear Programming (Numerical Methods)** Unimodal Function, Elimination Methods, Interpolation Methods, Direct Search Methods, Indirect Search Methods **UNIT-III** **Geometric Programming** Unconstrained Minimization Problem, Constrained Minimization, Primal Dual Relationships **Dynamic Programming** Bellman's principle of optimality, multistage decisions processes, concept of sub optimization, conversion of final value problem to initial value problem **UNIT-IV** **Non Traditional Optimization Techniques** Multi-objective Optimization, Genetic Algorithms, Simulated Annealing, Neural Network Based Optimization, Optimization of Fuzzy Systems

	Structural Optimization Methods of Optimum Structural elements, minimum weight design of truss members, optimum reinforced design of RCC slabs and beams, principles of optimization of design of multistorey structures, shell roofs, folded plates, water tanks
Text books and Reference books	**Text Book:** 1. Singiresu S. Rao (2011). "Engineering Optimization: Theory and Practice" New Age International Publishers, ISBN 978-81-224-2723-3 **Reference Books:** 1. Deb K, (1995), "Optimization for Engineering Design: Algorithms and Examples", Prentice Hall, New Delhi. 2. R2. Gallagher R.H. and O.C. Zienkiewicz, "Optimum Structural Design: Theory and Applications", John Wiley and Sons, ISBN 0-471-29050-5.
E-resources and other digital material	http://www.nptel.ac.in/courses/105108127/

CESE2006/1 DESIGN OF TALL STRUCTURES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Know about different loads and various systems of tall buildings
	CO2 Know about various structural systems and their behaviour
	CO3 Gain knowledge about static, dynamic and stability analysis of various systems.
	CO4 The student will be able to know about flooring systems and modern progress of tall buildings
Course Content	**UNIT-I** **Introduction:** History: advantages and disadvantages; essential amenities; fire safety; water supply; drainage and garbage disposal; service systems; structural and foundation systems; factors affecting height; growth and form ; human comfort criteria; Development of high-rise architecture; structural concepts. **Loads:** Gravity loading – Dead and Live load calculation; Impact and construction loads; Wind loading- static and dynamic approach-Analytical and wind tunnel experimental method; Earthquake loading-Equivalent lateral force; Modal analysis- combination of loading in various design philosophies. **UNIT-II** **Structural Systems:** Behaviour of High Rise structures- Different systems for load distribution in steel and concrete; Vertical and horizontal load resistant systems; Rigid frames; braced frames; in- filled frames; shear walls- wall frames; tubular systems; outrigger braced systems; mega systems.

	UNIT-III **Analysis And Design:** Analysis and design principles of various horizontal load transfer systems; approximate methods; modeling for accurate analysis- 3D analysis; member forces; displacements. Stability analysis- overall buckling analysis of frames; wall frames; approximate methods. Dynamic analysis- principles of design of tall braced frames for earthquake and blast resistant design. Detailing as per IS codes. **UNIT-IV** **Flooring Systems & Advanced Topics**: Introduction to various flooring systems in concrete and steel. Structural systems for future generation buildings; economics; need of new materials for design of tall buildings.
Text books and Reference books	**Text Book:** 1. Structural Analysis and Design of Tall Buildings by B.S.Taranath, Mc Graw Hill Co 1988. 2. Tall Building Structures by B.S.Smith and A.Coull , John Wiley & sons ,1991 **Reference Books:** 1. Structural Concepts and Systems for Architects and Engineers" by Lyn T.Y. and Burry D.Stotes, John Wiley, 1994. 2. High Rise Building Structures" by Sehuller .W.G, John Wiley & sons, 1977.
E-resources and other digital material	

CESE 2006/2 STRUCTURAL HEALTH MONITORING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1: understand the importance of structural health monitoring and smart materials.
	CO2: understand the vibration control using SHM.
	CO3: understand the piezo and Magnteostrictive layers.
	CO4: understand the SHM using LDV.
Course Content	**UNIT-I** **Introduction To Shm:** An Overview of Structural Health Monitoring; Structural Health Monitoring and Smart Materials; Structural Health Monitoring versus Non Destructive Evaluation; A broad Overview of Smart Materials; Emerging SHM Technologies using Piezo Sensors; SHM using Magnetostrictive Sensors; SHM using Optical Fibres and other sensors; Overview of Application Potential of SHM; Notable Applications of SHM – Aerospace and Civil Applications Underground Structures and Other Applications Understanding Piezoelectric Material; Understanding Magnetostrictive Material Optical Fibre and Lambwave method Solution Domain for SHM Other Damage Indices. **UNIT-II** Vibration Control using SHM – introduction to FE formulation; Constitutive Relationship; Element Stiffness Matrix for High Precision Finite Element; Element Mass Matrix for High Precision Finite Element; Developing Actuator and Sensor Influence Matrix; Estimating Sensor Voltage Active Control of Damping. **UNIT-III** Delamination Sensing using Piezo Sensory Layer; Voltage Response from Piezopatch; Electrical Impedance Method basic theory; A Case Study: Results and Discussions; SHM using Magnetostrictive Sensory Layer; Basics of Magnetization and Hysteresis; Delamination Sensing using Magnetostrictive Sensory

	Layer; Constitutive relationship with composite relationship; MS Layer in symmetric Laminate; MS Layer Away from the Midplane in Asymmetric Laminate; Case Studies related to MS Layer based SHM. **UNIT-IV** Experimental Modal Analysis using LDV – introduction; What is LDV; Velocity and Displacement Measurement using LDV; Case Study for Symmetric Laminate; Case Study for Cross-ply.
Text books and Reference books	**Text Book:** 1. Smart Materials and Structures, Gandhi and Thompson. 2. **S**tructural Health Monitoring: Current Status and Perspectives, Fu Ko Chang. 3. Journal Papers on this subject. **Reference Books:** **1.** Balageas D L, Structural health monitoring R & D at the European Research Establishment in Aerospace (EREA), Structural Health Monitoring–The Demands and Challenges, Third International Workshop on Structural Health Monitoring, p12-29, Stanford, CA. 2001**.** 2. Balageas D L, Structural health monitoring R&D at the European Research Establishments in Aerospace (EREA), Aerospace Science and Technology, **6**(3), p159-70, 2002.
E-resources and other digital material	

CESE 2006/3 ADVANCED BRIDGE ENGINEERING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1 Develops a sound Knowledge on basic concepts of proportioning and design of bridges in terms of aesthetics, geographical location and functionality
	CO2 Able to understand various flood discharges
	CO3 Understand the load distribution and IRC standards
	CO4 Ability to design various components of a bridge
	CO5 Ability to design post tensioned and box girder concrete bridges
Course Content	**UNIT-I** **Investigation for Major Bridges** Coverage; Topographical details; Catchment area map; Hydrological particulars; Geotechnical details; Seismology of the area; Navigational requirements; Construction resources; Particulars of nearest bridges; Traffic forecast. **Design of flood discharge** Introduction; Contribution factors; Methods of determination of design flood; Unit hydrograph method; Choice of method; Foundation design discharge **UNIT-II** **Design of Beam and slab bridge decks** Classification of bridges; Loads on bridges I.R.C. loading standards – Bridge slabs – Effective width method as per I.R.C. – Pigeaud's method – Bridge girders – Courbon's method – Assumptions and analysis and design of reinforced concrete T-beam bridge for Class AA tracked loading **Bridge decks and Structural Forms** Slab decks; Voided slab deck; Pseudoslab; Maunshell top Hat beam; Beam and slab; Box girders; Curved and skew deck

	UNIT-II **Piers and abutments** Types of piers and abutments; Materials of construction; Design of piers and abutments. **Foundations for bridges** Types of bridge foundations; Design of well foundations. **Behaviour and modeling of bridge decks** Simple beam method; Plate model; Articulated plate theory; Bridge responses – Longitudinal bending moment; Transverse bending moment; Longitudinal twisting moment and transverse bending moment; Longitudinal and transverse shear. **UNIT-IV** **Bearings** Classification and types of bearings; Guidelines for selection of bearings; Design considerations; Basis for metallic bearings; Ferrous bearings of traditional type; Design of elastometric bearings **Box Girder bridge decks** Box culvert (Single vent only) – Single span rigid frame bridges (Barrel of solid slab type only) **Prestressed Concrete Bridges** Genera aspects; Advantages of prestressed concrete bridges; Pre-tensioned prestressed concrete bridge decks; Post-tensioned prestressed concrete bridge decks; Design of post tensioned Prestressed concrete beam
Text books and Reference books	**Text Book:** 1. Bridge engineering by S.Ponnuswamy, TataMcGraw-Hill, 1986. 2. Bridge superstructure by N.Rajagopalan, Narosa Publishing House, 2006. 3. Prestressed concrete by N.Krishna Raju, Tata-McGraw-Hill, 1995. 4. Essentials of bridge engineering by D. John Victor, Oxford & IBH, 2001. **Reference Books:**
E-resources and other digital material	

CESE 2006/4 DESIGN OF INDUSTRIAL STRUCTURES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lectures**	3 hrs/week
		Continuous Evaluation:	40
		Semester end Evaluation:	60
		Total Marks:	100

Text books and Reference books	**Text Book:** 1. Manohar S.N, Tall Chimneys - Design and Construction, Tata McGraw Hill, 1985 2. Santhakumar A.R. and Murthy S.S., Transmission Line Structures, Tata McGraw Hill, 1992. 3. Srinivasulu P and Vaidyanathan.C, Handbook of Machine Foundations, Tata McGraw Hill, 1976. **Reference Books:** 1. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004.
E-resources and other digital material	
	Steel and RCC - Gantry Girder, Crane Girders - Design of Corbels and Nibs – Design of Staircase. **UNIT III** **Power Plant Structures** Types of power plants – Containment structures - Cooling Towers - Bunkers and Silos - Pipe supporting structures **UNIT IV** **Transmission Line Structures And Chimneys** Analysis and design of transmission line towers - Sag and Tension calculations, Testing of towers – Design of self supporting chimney, Design of Chimney bases. **Foundation** Design of foundation for Towers, Chimneys and Cooling Towers - Machine Foundation - Design of Turbo Generator Foundation.

CESE 2051 STRUCTURAL ENGINEERING LABORATORY

Course Category:	Programme Elective	**Credits:**	2
Course Type:	Lab	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1: Obtain the unknown resistance and static strain using accepted principles
	CO2: Determine the principal stresses for various loadings
	CO3: Determine the response of three storeyed building under harmonic and non-harmonic base motions
	CO4: Understand and apply the concept of Vibration isolation and vibration absorber
Course Content	1. Measurement of unknown resistance using Wheatstone bridge. 2. Measurement of static strain by electrical resistance strain gauge. 3. Determination of the material fringe value of a given photo elastic material. 4. Determination of principal stress difference in a circular disc subjected to diametrical compression. 5. Determination of principal stresses in a bar subjected to axial tension. 6. Determination of stress concentration factor. 7. Dynamics of a three storey building frame subjected to harmonic base motion. 8. Dynamics of three storey building frame subjected to non-harmonic (periodic) base motion. 9. Dynamics of a one-storey building frame with planar asymmetry subjected to harmonic base motion. 10. Vibration Isolation of a secondary system. 11. Dynamics of a vibration absorber.

CESE 2052COMPUTER AIDED PROJECT MANAGEMENT

Course Category:	Programme Elective	**Credits:**	2
Course Type:	Lab	**Lectures**	3 hrs/week
		Continuous Evaluation: **Semester end Evaluation:** **Total Marks:**	40 60 100

Course outcomes	On successful completion of the course, the student will be able to:
	CO1Develop a plan using drafting tool
	CO2Develop an estimate and network for a project
	CO3Assign the interdependencies of the activities
	CO4Monitor the progress of the project
Course Content	1.Develop a project plan for a small residential building using drafting tools. 2. Develop an Estimate for the above project. 3. Determination of activities & their interdependencies with corresponding scheduled time. 4.Develop a network using project management tools. 5. Create and assign project resources for all the tasks. 6.Update the progress of the project. Note: All the experiments should be done using AutoCAD/ Microsoft Excel/ Microsoft Project/ Primavera and any other project management softwares.
Text books and Reference books	1. Construction Engineering and Management by S.Seetharaman, Umesh Publications, 2003. 2. Total construction project management by G.J.Ritz, McGraw-Hill Professional, 1993.