INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
(Approved by AICTE | NAAC Accreditation with 'A++' Grade | Accredited by NBA | Affiliated to JNTUH)
Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY
STRUCTURAL ENGINEERING

ACADEMIC REGULATIONS, COURSE CATALOG AND SYLLABI
MT25

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2025 - 2026)

These rules and regulations may be altered/changed from time to time by the academic council
FAILURE TO READ AND UNDERSTAND THE RULES IS NOT AN EXCUSE

INSTITUTE VISION | MISSION | QUALITY POLICY

VISION

To bring forth students, professionally competent and socially progressive, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

QUALITY POLICY

Our policy is to nurture and build diligent and dedicated community of engineers providing a professional and unprejudiced environment, thus justifying the purpose of teaching and satisfying the stake holders.

A team of well qualified and experienced professionals ensure quality education with its practical application in all areas of the Institute.

DEPARTMENT VISION | MISSION

VISION

To produce excellent professionals, who will provide engineering solutions for infrastructure development and managing sustainable socio-economic advancement.

MISSION

Advancing innovative civil engineering solutions for society and creating leaders by integrating experiential education to face complex technical challenges.

OR

M1: To advance innovative solutions through experiential education.
M2: To encourage leadership qualities and expertise.
M3: To prepare professionals for addressing complex technical challenges.

M.TECH (Structural Engineering) - PROGRAM OUTCOMES (PO's)	
Upon completion of M.Tech Structural Engineering, the students will be able to:	
PO1:	An ability to Independently carry out research/investigation and development work to solve practical problems.
PO2:	An ability to Write and present a substantial technical report/document.
PO3:	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4:	Capable to apply the core, multidisciplinary knowledge for understanding the problems in structural engineering and allied fields.
PO5:	Conceptualize and design civil engineering structures considering various socio-economic factors.
PO6:	Engage in life-long learning for continuing education in research-level studies and professional development.

CONTENTS

“Take up one idea.
Make that one idea you’re life-think of it, dream of it, and live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success” Swami Vivekananda

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Certificate course: It is a course that makes a student gain hands-on experience and skill required for holistic development in a specific area/field.

Choice Based Credit System: The credit-based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards internal assessment.

Course: A course is a course offered by the institute for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources and processes for evaluating the attainment of Program Educational Objectives.

Degree with Specialization: A student who fulfills all the program requirements of her/his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like Aerospace Engineering, Computer Science and Engineering, Embedded Systems, Electrical Power Systems, CAD/CAM, Structural Engineering etc.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Detention in a course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 point scale.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self-learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Master of Technology (M.Tech) degree program

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research-based work to be taken up by a student during his / her second year to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, course to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all M.Tech programs offered by Institute are designated as "MT25" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 weeks of academic work equivalent to normally 80 to 85 working days. The odd semester starts usually in July and even semester in December (Tentatively).

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

Words 'he', him', 'his', occur, they imply 'she', 'her', 'hers' also.

PREFACE

Dear Students,

The focus at IARE is to deliver value-based education with academically well qualified faculty and infrastructure. It is a matter of pride that IARE continues to be the preferred destination for students to pursue an engineering degree.

In the year 2015, IARE was granted academic autonomy status by University Grants Commission, New Delhi under Jawaharlal Nehru Technology University Hyderabad. From then onwards, our prime focus is on developing and delivering a curriculum which caters to the needs of various stakeholders. The curriculum has unique features enabling students to develop critical thinking, solve problems, analyze socially relevant issues, etc. The academic cycle designed on the basis of Outcome Based Education (OBE) strongly emphasizes continuous improvement and this has made our curriculum responsive to current requirements.

The curriculum at IARE has been developed by experts from academia and industry and it has unique features to enhance problem solving skills apart from academic enrichment. The curriculum of M.Tech program has been thoroughly revised as per AICTE / UGC / JNTUH guidelines and have incorporated unique features such as competency training / coding, industry driven elective, internship and many more. The curriculum is designed in a way so as to impart engineering education in a holistic approach towards Excellence.

I hope you will have a fruitful stay at IARE.

Dr. L V Narasimha Prasad
Principal

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad – 500 043

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2025-26)

For pursuing Two year postgraduate Master Degree program of study in Engineering (M.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

1. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course catalogue to Choice Based Credit System (CBCS) along with introduction to semester system from first semester itself. It helps in accelerating the teaching learning process and enables vertical and horizontal mobility in learning.

The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / dissertation work / mini project with seminar / dissertation viva-voce / seminars / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

1. Choose electives from a wide range of elective courses offered by the departments of the Institute.
2. Undergo additional courses of interest.
3. Adopt an inter-disciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2. MEDIUM OF INSTRUCTION

The medium of instruction shall be **English** for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course curriculum in accordance with the prescribed syllabi.

3. ELIGIBILITY FOR ADMISSION

The admissions for category A and B seats shall be as per the guidelines of Telangana State Council for Higher Education (TSCHE) in consonance with government reservation policy.

a) Under Category A: 70% of the seats are filled based on GATE/PGECET ranks.
b) Under Category B: 30% seats are filled on merit basis as per guidelines of TSCHE.

4. UNIQUE COURSE IDENTIFICATION CODE

Every specialization of the M.Tech program will be placed in one of the groups as listed in the Table 1.

Table 1: Group of Courses

S.No	Specialization	Offering Department	Code
1	Structural Engineering	Civil Engineering	ST
2	Electrical Power Systems	Electrical and Electronics Engineering	PS
3	Embedded Systems	Electronics and Communication Engineering	ES
4	Computer Science and Engineering	Computer Science and Engineering	CS
5	Aerospace Engineering	Aeronautical Engineering	AE

5. TYPES OF COURSES

Courses in a program may be of four kinds: **Core courses, Elective courses and Audit courses.**

5.1 Core Courses:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in said discipline of study.

5.2 Elective Courses:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

There shall be five professional core elective groups out of which students can choose not more than two courses from each group. Overall, students can opt for professional elective courses which suit their project work in consultation with the faculty advisor / mentor. In addition, one course from each of the open elective has to be selected.

5.3 Open Elective Courses:

An elective may be discipline centric focusing on those courses which add generic proficiency to the students or may be chosen from supportive / general discipline called as "Open Elective".

5.4 Mandatory Audit Courses:

The student may opt for audit courses, starting in first semester onwards. Audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in first and second semesters are provided in curriculum. Student can choose one audit course from the list. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

For mandatory non-credit audit courses, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the course. These marks should also be uploaded along with the internal marks of other courses.

No marks or letter grades shall be allotted for mandatory non-credit audit courses. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

6. SEMESTER STRUCTURE

The M.Tech. Programs in institute are of semester pattern, with four semesters consisting of Two academic years. Each academic year having Two Semesters: Odd and Even. There shall be a minimum of 15 weeks of instruction, excluding the mid-term and semester-end exams. Around 15 instruction hours, 30 instruction hours and 45 hours of learning need to be followed per one credit of theory course, practical course and project/field-based learning respectively.

The two-year M.Tech program consists of 68 credits and the student has to register for all 68 credits and earn all 68 credits for the award of M.Tech degree. There is NO exemption of credits in any case.

UGC/AICTE specified definitions/descriptions are adopted appropriately for various terms and abbreviations used in these PG academic regulations, as listed below:

Each Semester shall have 'Continuous Internal Assessment (CIA)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of regulations.

Before commencement of the class work, students are required to register the courses through Samvidha (Student Management Portal) without fail.

7. PROGRAM DURATION

A student shall be declared eligible for the award of M.Tech degree, if he/she pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years. A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

a) A student will be eligible for the award of M.Tech degree on securing a minimum of 6.0/10.0 CGPA.

b) In the event of non-completion of Dissertation Work and / or non-submission of the Dissertation Work report by the end of the fourth semester, the candidate shall re-register by paying the semester fee for the Dissertation Work. In such a case, the candidate will not be permitted to submit the Dissertation Work report earlier than three months and not later than six months from the date of registration.

8. CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core courses (CoC), Elective courses (ElC) – Professional electives & Open electives, Audit courses, Laboratory courses, Mini project with seminar, Dissertation work review–II and Dissertation work review–III and Dissertation Viva-Voce.

Each Theory and Laboratory course carries credits based on the number of Hours / Week as follows:

- **Lecture Hours (Theory):** 1 credit per lecture hour per week.
- **Laboratory Hours (Practical):** 1 credit for 2 practical hours, 2 credits for 3 or 4 practical hours per week.
- **Dissertation Work / Project work:** 1 credit for 2 hours of project work per week.

Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations and mandatory courses (Non-credit Audit Courses) will not carry any credits.

8.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S.No	Course	Hours	Credits
1	Core Courses	3	3
2	Professional Elective Courses	3	3
3	Audit Courses	2	0
4	Laboratory Courses	4	2
5	Open Elective Courses	3	3
6	Mini Project with Seminar	4	2
7	Dissertation Work Review – II	18	6
8	Dissertation Work Review – III	18	6
9	Dissertation Viva-Voce	42	14

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Professional Core Courses (04) + Professional Core Electives (05) + Open Electives (01)	04@3 credits + 05 @ 3 credits + 01@3 credits	30
Total Laboratory Courses (04)	04@ 2 credits	08
Mini Project with Seminar (01)	1@ 2 credits	02
Research Methodology and IPR	1@ 2 credits	02
Dissertation Work Review – II	1 @ 6 credits	06
Dissertation Work Review – III	1 @ 6 credits	06
Dissertation Viva -Voce	1 @14 credits	14
	Total Credits	**68**

9. EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, out of which 40 marks for Continuous Internal Assessment (CIA) and 60 marks for Semester End Examination (SEE).

9.1.1 Semester End Examination (SEE):

The semester end examinations, for theory courses, will be conducted for 60 marks consisting of two parts viz. i) Part- A for 10 marks and ii) Part - B for 50 marks.

Part-A is compulsory, consists of five short answer questions; each question carries two marks.

Part-B consists of five questions carrying 10 marks each. There shall be two questions asked in the question paper from each module with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five modules.

The duration of SEE is 3 hours.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

9.1.2 Continuous Internal Assessment (CIA):

The performance of a student in each semester shall be evaluated course- wise (irrespective of credits assigned) for a maximum of 100 marks. For each theory course, the CIA shall be conducted. The CIA is evaluated for a total of 40 marks.

The performance of a student in every course (including practicals and Project) will be evaluated for 100 marks each, with 40 marks allotted for CIA (Continuous Internal Assessment) and 60 marks for SEE (Semester End-Examination).

In CIE, for theory courses, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) Part – A for 10 marks, ii) Part – B for 20 marks with a total duration of two hours as follows:

1. Mid-Term Examination for 30 marks:
a. Part - A: Objective/quiz paper for 10 marks.
b. Part – B: Descriptive paper for 20 marks.

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.

The remaining 10 marks of Continuous Internal Assessment (out of 40) are distributed as:
2. 5 marks for Assignment. (Average of 2 Assignments each for 5 marks)
3. Course Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned course for 5 marks

Note:

First internal examination shall be conducted on 50% of the syllabus, and the second internal examination shall be conducted on the remaining 50% of the syllabus.

The Semester End Examinations (SEE), for theory courses, will be conducted for 60 marks consisting of two parts viz. i) Part- A for 10 marks, ii) Part - B for 50 marks.

Part-A is a compulsory question which consists of ten sub-questions with uniform coverage from all units carrying equal marks.

Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an “either” “or” choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

The duration of Semester End Examination is 3 hours.

9.2 Laboratory Course: For practical courses there shall be a Continuous Internal Assessment (CIA) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of Preparation / Performance in the laboratory / Calculations and graphs / Results and error analysis / Viva-voce) which shall be evaluated for **10 marks**.
2. **10 marks** for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned**.**
3. Internal practical examination conducted by the course handling faculty shall be evaluated for **10 marks.**
4. The remaining **10 marks** are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination held for three hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course
5. 10 marks for viva-voce on concerned laboratory course.

The student, in each course, shall have to earn 40% of marks (i.e. 16 marks out of 40 marks) in CIE, 40% of marks (i.e. 24 marks out of 60) in SEE and Overall, 50% of marks (i.e. 50 marks out of 100 marks) both CIE and SEE marks taking together.

In case, the student appears for Semester End Examination (SEE) of the concerned course but not scored minimum 40% of CIA marks (16 marks out of 40 internal marks), his performance in that course in SEE shall stand cancelled inspite of appearing the SEE.

9.3 Mini Project with Seminar

There shall be Mini Project with Seminar during II semester for internal evaluation of 100 marks. The Departmental Academic Committee (DAC) will review the progress of the mini project during the seminar presentations and evaluate the same for 50 marks. Mini Project Viva Voce will be evaluated by the DAC for another 50 marks before the semester end examinations. Student shall carryout the mini project in consultation with the mini project supervisor which may include critically reviewing the literature, project implementation and submit it to the department in the form of a report and shall make an oral presentation before the DAC consisting of Head of the Department, Supervisor and two other senior faculty members of the department. The student has to secure a minimum of 50% of marks in i) seminar presentation and ii) mini project viva voce, to be declared successful. If he fails to obtain the minimum marks, he has to reappear for the same as and when scheduled.

9.4 Every candidate shall be required to submit a dissertation on a topic approved by the Dissertation Review Committee.

9.5 Dissertation Work

Normally, the **Dissertation Work** should be carried out at Host Institute (Institute of Aeronautical Engineering). However, it can also be carried out in any of the recognized educational institutions, National Laboratories, Research Institutions, Industrial Organizations, Service Organizations or Government Organizations with the prior permission from the guide and concerned Head of the Department. A student shall submit the outcome of the project work in the form of a dissertation.

Registration of Dissertation Work: A candidate is permitted to register for the Dissertation Work after satisfying the attendance requirement in all the courses, both theory and laboratory. After satisfying the attendance requirement candidate must present in Dissertation Work Review - I, in consultation with his

supervisor, the title, objective and plan of action of his/her Dissertation work to the Project Review Committee (PRC) for approval within four weeks from the commencement of III semester. Only after obtaining the approval of the PRC can the student initiate the Dissertation work.

- A candidate shall submit his Dissertation progress report in two stages at least with a gap of three months between them.
- If a candidate wishes to change his supervisor or topic of the Dissertation, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of Dissertation proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.
- The student shall submit the Dissertation Work Review - II project work at the end of III semester for evaluation. The Dissertation Work Review – II shall be evaluated by Project Review Committee (PRC) at the end of the third semester for a maximum of 100 marks. Head of the Department (HOD) shall constitute a PRC comprising of senior faculty of the specialization, Supervisor / Guide and Head of the Department.
- The final phase of Dissertation Work Review - III project work is to be carried out in IV semester. The student will be allowed to appear for final Dissertation Evaluation (viva - voce) examination at the end of IV semester only if s/he has submitted s/he project work in the form of paper for presentation / publication in a conference / peer reviewed journals and produce the proof of acceptance of the paper from the organizers / publishers.
- Dissertation Work Reviews - II and III shall be conducted in phase I (Regular) and Phase II (Supplementary). Phase II will be conducted only for unsuccessful students in Phase I. The unsuccessful students in Dissertation Work Review - II (Phase II) shall reappear for it at the time of Dissertation Work Review - III (Phase I). These students shall reappear for Dissertation Work Review - III in the next academic year at the time of Dissertation Work Review - II only after completion of Dissertation Work Review - II, and then Dissertation Work Review - III follows. The unsuccessful students in Dissertation Work Review - III (Phase II) shall reappear for Dissertation Work Review - III in the next academic year only at the time of Dissertation Work Review - II (Phase I).
- After approval from the PRC, a soft copy of the thesis should be submitted for Anti-Plagiarism check and the plagiarism report should be submitted to the University and be included in the final thesis. The Thesis will be accepted for submission, if the similarity index is less than 30%. If the similarity index is more than the required percentage, the student is advised to revise the thesis and re-submit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to TWO. The candidate has to register for the Dissertation work and work for two semesters. After three attempts, the admission is liable to be cancelled.

The evaluation of the project work and the marks allotted are as under:

S.No	Dissertation Work Reviews	Mode	Evaluation Committee	Marks
1	Dissertation Work Review - II	Continuous evaluation at the end of III Semester	Supervisor / Guide	50
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, Supervisor / Guide and HOD.	50
Total Marks				**100**
3	Dissertation Work Review - III	Continuous evaluation at the end of IV semester and open pre-submission seminar by the student	Supervisor / Guide	50
4		Evaluation at the end of	Project Review Committee (PRC)	50

		IV Semester	comprising of senior faculty of the specialization, Supervisor / Guide and HOD.	
Total Marks				**100**
End Semester Examination (An Open seminar followed by Viva-Voce)			The External Evaluation Committee (EEC) comprising of External Examiner, HOD and Supervisor / Guide wherein the HOD shall be the chairman of the committee.	**100**

9.3.4 As soon as a student submits Dissertation Work, Principal shall appoint the external examiner among the panel of examiners recommended by the Chairman, BOS (PG).

9.3.5 The Controller of examinations shall schedule the Semester End Examination of Dissertation Work soon after the completion of the study of program and a student can appear for the same provided s/he has earned successfully all the requisite credits. The student shall produce the dissertation work duly certified by the supervisor / guide and HOD during the examination.

9.3.6 The Dissertation Work reports of M.Tech students who have not completed their course work successfully will be evaluated in that semester itself and the result sent confidentially to the controller of examinations. The results of the Dissertation Work evaluation will be declared only after the successful completion of the courses by those students.

10. ATTENDANCE REQUIREMENTS AND DETENTION POLICY

The programs are offered based on a unit system with each course being considered a unit. Attendance is calculated separately for each course.

10.1 Attendance in all classes (Lectures/Laboratories) is compulsory. The minimum required attendance in each theory course (***also mandatory Audit Courses***) including the attendance of mid-term examination / Laboratory etc. is 75%. Two periods of attendance for each theory course shall be considered, if the student appears for the mid-term examination of that course. A student shall not be permitted to appear for the Semester End Examinations (SEE), if s/he attendance is less than 75%.

10.2 A student's seminar report and presentation on mini project shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in seminar presentation classes during that semester.

10.3 **Condoning of shortage of attendance** (between 65% and 75%) up to a maximum of 10% (considering the days of attendance in sports, games, NCC, NSS activities and medical grounds) in each course (Theory / Laboratory / Mini Project with Seminar) of a semester shall be granted by the institute academic committee on genuine reasons.

10.4 A prescribed fee per course shall be payable for condoning shortage of attendance.

10.5 Shortage of Attendance below 65% in any course shall in **no case be condoned.**

10.6 A Student, whose shortage of attendance is not condoned in any course(s) (Theory/Laboratory/Mini Project with Seminar) in any semester, is considered as 'Detained in that course(s), and is not eligible to write Semester End Examination(s) of such course(s), (in case of Mini Project with Seminar, s/he Mini Project with Seminar Report or Presentation are not eligible for evaluation) in that Semester; and s/he has to seek re-registration for those course(s) in subsequent semesters, and attend the same as and when offered.

10.7 A student fulfills the attendance requirement in the present semester, shall not be eligible for readmission into the same class.

10.8 **a)** A student shall put in a minimum required attendance in at least **three theory courses (excluding *mandatory (non-credit audit)* course)** in first semester for promotion to second semester.

b) A student shall put in a minimum required attendance in at least **three theory courses (excluding *mandatory (non-credit audit)* course)** in second semester for promotion to third semester.

11. CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

11.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

11.2 The Controller of Examinations (COE) shall invite external examiners to evaluate all semester end examination answer scripts on the scheduled dates. Similarly, practical laboratory examinations shall be conducted in the presence of external examiners to ensure transparency and fair evaluation.

11.3Examinations control office shall consolidate the marks awarded by examiner/s and award the grades.

12. SCHEME FOR THE AWARD OF GRADE

The following academic requirements must be satisfied, in addition to the attendance requirements mentioned in clause no. 10. The performance of the candidate in each semester shall be evaluated course-wise, with a maximum of 100 marks per course (theory / practical), based on Continuous Internal Assessment and Semester End Examination.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course, if he secures not less than 40% of marks (24 out of 60 marks) in the Semester End Examination (SEE), and a minimum of 50% of marks in the sum total of CIA (Continuous Internal Assessment) and SEE (Semester End Examination) taken together; in terms of Letter Grades and this implies securing 'B' Grade or above in a course.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Mini Project with seminar, if student secures not less than 50% marks (i.e. 50 out of 100 allotted marks). The student would be treated as failed, if student (i) does not submit a seminar report on Mini Project or does not make a presentation of the same before the evaluation committee as per schedule or (ii) secures less than 50% marks in Mini Project with seminar evaluation. The failed student shall reappear for the above evaluation when the notification for supplementary examination is issued.

A student shall register for all courses for total of 68 credits as specified and listed in the course structure for the chosen specialization, put in the required attendance and fulfill the academic requirements for securing 68 credits obtaining a minimum of 'B' Grade or above in each course, and shall pass all the Audit Courses to complete the M.Tech. program successfully.

If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

Note:

(1) The SGPA will be computed and printed on the marks memo only if the candidate passes in all the courses offered and gets minimum B grade in all the courses.

(2) CGPA is calculated only when the candidate passes in all the courses offered in all the semesters.

Letter Grades obtained in all those courses covering the above specified 68 credits alone shall be considered for the calculation of final CGPA, which will be indicated in the consolidated grade memo.

When a student is detained due to shortage of attendance in any course(s) in any semester, shall not be permitted to write the SEE. However, he is eligible for re-registration of such course(s) in the subsequent semester(s), as and when next offered, with the academic regulations of the batch into which he is re-registered, by paying the prescribed fees per course. In all these re-registration cases, the student shall have to secure a fresh set of internal marks and SEE marks for performance evaluation in such course(s), and SGPA/CGPA calculations.

A student eligible to appear for the SEE in any course, but absent from it or failed (failing to secure 'B' Grade or above), may reappear for that course at the supplementary examination as and when conducted. In such cases, his internal marks assessed earlier for that course will be carried over, and added to the marks secured in the supplementary semester end examination, for the purpose of evaluating his performance in that course.

A student who fails to earn 68 credits as per the specified course catalogue, and as indicated above, within four academic years from the date of commencement of his/her first year first semester, shall forfeit his/her seat in M. Tech. program and his admission shall stand cancelled.

13.0 LETTER GRADES AND GRADE POINTS

13.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10 point grading system with the following letter grades as given below:

% of Marks Secured in a Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above (≥90%, ≤100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥80%, <90%)	A+ (Excellent)	9
Below 80% but not less than 70% (≥70%, <80%)	A (Very Good)	8
Below 70% but not less than 60% (≥60%, <70%)	B+ (Good)	7
Below 60% but not less than 50% (≥50%, <60%)	B (above Average)	6
Below 50% (<50%)	F (Fail)	0
Absent	AB (Absent)	0

13.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: "O", "A+", "A", "B+", "B".

13.3 A student obtaining grade "F" shall be considered failed and will be required to reappear in the examination.

13.4 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{\{i=1\}}^{n} (C_i G_i) \Big/ \sum_{\{i=1\}}^{n} C_i \quad \text{.... For each semester}$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student's is registered in the concerned semester.

$$CGPA = \sum_{\{j=1\}/}^{M} (C_i G_i) / \sum_{\{j=1\}\ldots \text{for each semester}}^{M} C_i$$

Where, G_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Conversion of CGPA into equivalent Percentage of Marks

The following formula shall be used for the conversion of CGPA into equivalent marks, whenever it is necessary

Percentage (%) of Marks = (Final CGPA – 0.5) x 10

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration of calculation of SGPA

Course	Credits	Letter Grade	Grade Points	Credit Points (Credit x Grade)
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	B	6	4 x 6 = 24
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B	6	3 x 6 = 18
	21			**159**

Thus, SGPA = 159 / 21 = 7.57

15.2 Illustration of calculation of CGPA from SGPA

Semester	Credits	SGPA	Credits * SGPA
Semester I	24	7	24 * 7 = 168
Semester II	24	6	24 * 6 = 144
Semester III	24	6.5	24 * 6.5 = 156
Semester IV	24	6	24 * 6 = 144
	96		**612**

Thus, *CGPA = 612* / 96 = 6.37

16.0 REVALUATION

A student, who seeks the revaluation of the answer script, is directed to register and pay the requisite fee within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of M.Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 68 credits.

17.2 A student who fails to earn 68 credits within four consecutive academic years from the year of his/her admission (with CGPA ≥ 6.0), shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE

After a student has earned the requirements prescribed for the completion of the program and is eligible for the award of M.Tech degree, s/he shall be placed in one of the following three classes based on the CGPA:

Classification of degree will be as follows:

Class Awarded	CGPA
First Class with Distinction	≥ 7.50
First Class	$6.50 \leq$ CGPA < 7.50
Second Class	$6.00 \leq$ CGPA < 6.50

Note: A student with final CGPA (at the end of the M.Tech program) < 6.00 shall not be eligible for the award of degree.

All the candidates who register for the semester end examination will be issued grade sheet by the Institute. Apart from the semester wise marks memos, the institute will issue the provisional certificate to the fulfillment of all the academic requirements.

19.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student may be asked to leave the institute in the following circumstances:

a) The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b) The student fails to satisfy the norms of discipline specified by the institute from time to time.

20. WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the college / if any case of indiscipline / malpractice is pending against him/her, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

21. DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

22. GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

23. TRANSITORY REGULATIONS

A student who has been detained in any semester of previous regulations for not satisfying the attendance requirements shall be permitted to join in the corresponding semester of this regulation.

SEE in each course under the regulations that precede immediately these regulations shall be conducted three times after the conduct of last regular examination under those regulations. Thereafter, the failed students, if any, shall take examination in the equivalent papers of these regulations as suggested by the Chairman (BOS) concerned.

24. MAPPING WITH THE SUSTAINABLE DEVELOPMENT GOALS

All the courses specified in the course catalogue of every program are mapped with the one or more sustainable development goals.

25. REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2. Shall IARE award its own Degrees?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. What is the difference between a Deemed University and an Autonomy College?

A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built-in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Program Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. IARE has introduced its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. Can IARE have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9. Can IARE give a provisional degree certificate?

Since the examinations are conducted by IARE and the results are also declared by IARE, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore, with the prior permission of the University the college will be entitled to give the provisional certificate.

10. Will Academic Autonomy make a positive impact on the Placements or Employability? Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11. What is the proportion of Internal and External Assessment as an Autonomous College?
Presently, it is 60 % external and 40% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. Is it possible to have complete Internal Assessment for Theory or Practicals?
Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13. Why Credit based Grade System?
The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14. What exactly is a Credit based Grade System?
The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B, C, D, etc. are assigned for a Range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15. What are the norms for the number of Credits per Semester and total number of Credits for UG/PG program?
These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16. What is a Semester Grade Point Average (SGPA)?
The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{\{i=1\}}^{n} (C_i G_i) / \sum_{\{i=1\}}^{n} C_i \quad \text{.... For each semester}$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and I represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17. What is a Cumulative Grade Point Average (CGPA)?

An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{\{j=1\}/}^{M} (C_i G_i) / \sum_{\{j=1\}\ldots \text{for each semester}}^{M} C_i$$

Where, G_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester and j represent the number of courses in which a student's is registered upto the semester. CGPA is rounded to two decimal places.

18. Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes, the institute has its own MIS software for calculation of SGPA, CGPA, etc.

19. Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20. How fast syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

21. Will the Degree be awarded on the basis of only final year performance?

No. The CGPA will reflect the average performance of all the semester taken together.

22. What are Statutory Academic Bodies?

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in everybody is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

23. Who takes Decisions on Academic matters?

The Governing Body and Academic Council of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

24. What is the role of Examination committee?

The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations, spot valuations, tabulations and preparation of Grade Cards etc., fall within the duties of the Examination Committee.

25. Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean - Planning, Monitoring & Continuing Studies.

26. How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

27. Who declares the result?
The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared and is eventually sent to the University.

28. Who will keep the Student Academic Records, University or IARE?
It is the responsibility of the examinations control Autonomous College to keep and preserve all the records.

29. What is our relationship with the JNT University Hyderabad?
We remain an affiliated college of the JNT University Hyderabad. The University has the right to nominate its members on the academic bodies of the college.

30. Shall we require University approval if we want to start any New Courses?
Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

31. Shall we get autonomy for PG and Doctoral Programs also?
Yes, presently our PG programs also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S. No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE CATALOGUE

REGULATIONS: MT25

STRUCTURAL ENGINEERING

I SEMESTER

Course Code	Course Name	Course Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BSTE01	Advanced Structural Analysis	PCC	Core	3	0	0	3	40	60	100
BSTE02	Theory of Elasticity and Plasticity	PCC	Core	3	0	0	3	40	60	100
	Professional Elective - I	PE	Elective	3	0	0	3	40	60	100
	Professional Elective - II	PE	Elective	3	0	0	3	40	60	100
BHSE01	Research Methodology & IPR	--	--	2	0	0	2	40	60	100
	Audit Course - I	Audit - I	Audit	2	0	0	0	-	-	-
PRACTICAL										
BSTE11	Advanced CAD Laboratory	PCC	Core	0	0	4	2	40	60	100
BSTE12	Advanced Concrete Laboratory	PCC	Core	0	0	4	2	40	60	100
TOTAL				**16**	**00**	**08**	**18**	**280**	**420**	**700**

II SEMESTER

Course Code	Course Name	Course Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BSTE13	Finite Element Analysis	PCC	Core	3	0	0	3	40	60	100
BSTE14	Structural Dynamics	PCC	Core	3	0	0	3	40	60	100
	Professional Elective - III	PE	Elective	3	0	0	3	40	60	100
	Professional Elective - IV	PE	Elective	3	0	0	3	40	60	100
	Audit Course - II	Audit - II	Audit	2	0	0	0	--	--	--
PRACTICAL										
BSTE23	Structural Design Laboratory	PCC	Core	0	0	4	2	40	60	100
BSTE24	Numerical Analysis Laboratory	PCC	Core	0	0	4	2	40	60	100
BSTE25	Mini Project with Seminar	PCC	Core	0	0	4	2	40	60	100
TOTAL				**14**	**00**	**12**	**18**	**280**	**420**	**700**

III SEMESTER

Course Code	Course Name	Course Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
	Professional Elective – V	PE	Elective	3	0	0	3	40	60	100
	Open Elective	OEC	Elective	3	0	0	3	40	60	100
PROJECT										
BSTE34	Dissertation Work Review - II	Major Project	Core	0	0	18	6	40	60	100
TOTAL				**06**	**00**	**18**	**12**	**120**	**180**	**300**

IV SEMESTER

Course Code	Course Name	Course Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
BSTE35	Dissertation Work Review - III	Major Project	Core	0	0	18	6	40	60	100
BSTE36	Dissertation Viva-Voce	--	Core	0	0	42	14	-	100	100
TOTAL				**00**	**00**	**60**	**20**	**40**	**160**	**200**

ELECTIVE COURSES

PROFESSIONAL CORE ELECTIVES (PCE)

S.No	Course Code	Course Name	Professional Electives
1	BSTE03	Analytical and Numerical Methods for Structural Engineering	I
2	BSTE04	Special Concretes	I
3	BSTE05	Optimization Techniques	I
4	BSTE06	Reliability Analysis of Structures	I
5	BSTE07	Theory of Plates and Shells	II
6	BSTE08	AI in Structural Engineering	II
7	BSTE09	Stability Analysis of Structures	II
8	BSTE10	Design of Precast and Composite Structures	II
9	BSTE15	Design of advanced Concrete Structures	III
10	BSTE16	Design of High-Rise Structures	III
11	BSTE17	Design of Masonry Structures	III
12	BSTE18	Bridge Engineering	III
13	BSTE19	Advanced Steel Design	IV
14	BSTE20	Design Concepts of Substructures	IV
15	BSTE21	Design of Industrial Structure	IV
16	BSTE22	Maintenance and Rehabilitation of Structures	IV
17	BSTE26	Design of Pre stressed Concrete Structures	V
18	BSTE27	Introduction to Machine Learning and Deep Learning	V
19	BSTE28	Theory of Plasticity and Fracture Mechanics	V
20	BSTE29	Earthquake Resistant design of Buildings	V

OPEN ELECTIVE COURSES FOR OTHER DEPARTMENTS

S.No	Course Code	Course Name
1	BSTE30	Cost Management of Engineering Projects
2	BSTE31	Waste to Energy
3	BSTE32	Industrial Safety
4	BSTE33	Energy Efficient Buildings

AUDIT COURSES – I AND II

S.No	Course Code	Course Name
1	BHSE02	English for Research Paper Writing
2	BHSE03	Disaster Management
3	BHSE04	Sanskrit for Technical Knowledge
4	BHSE05	Value Education
5	BHSE06	Constitution of India
6	BHSE07	Pedagogy Studies
7	BHSE08	Stress Management by Yoga
8	BHSE09	Personality Development through Life Enlightenment Skills

SYLLABUS
(I – III SEMESTERS)

Mapping of Courses with SDGs

I. Professional Core Courses (PCC)

S.No	Course Code	Course Name	Relevant SDGs	Justification
1	BSTE01	Advanced Structural Analysis	**SDG 9**	Enhances computational proficiency to analyze and optimize structural systems using modern engineering tools.
2	BSTE02	Theory of Elasticity and Plasticity	**SDG 9**	Strengthens understanding of material behavior under stress, vital for designing resilient structures.
3	BHSE01	Research Methodology & IPR	**SDG 4**	Develops research ethics, technical writing, and intellectual property awareness for innovative contributions.
4	BSTE11	Advanced CAD Laboratory	**SDG 9**	Promotes digital design and modeling proficiency for accurate structural detailing and simulation.
5	BSTE12	Advanced Concrete Laboratory	**SDG 12**	Encourages experimentation with sustainable materials and high-performance concrete for eco-friendly construction.
6	BSTE13	Finite Element Analysis	**SDG 9**	Provides computational tools to solve complex structural problems accurately and efficiently.
7	BSTE14	Structural Dynamics	**SDG 13**	Equips students with knowledge of dynamic loading behavior, essential for earthquake- and wind-resistant design.
8	BSTE23	Structural Design Laboratory	**SDG 9**	Hands-on experience in design of reinforced and steel structures following codal provisions.
9	BSTE24	Numerical Analysis Laboratory	**SDG 9**	Develops numerical problem-solving skills essential for simulation and automation in design.
10	BSTE25	Mini Project with Seminar	**SDG 4**	Promotes self-directed learning, innovation, and presentation of research outcomes.
11	BSTE34	Dissertation Work Review – II	**SDG 4, SDG 9**	Encourages applied research and continuous review of innovation in structural design and materials.
12	BSTE35	Dissertation Work Review – III	**SDG 4, SDG 9**	Focuses on technical review, experimental validation, and interpretation of research outcomes.
13	BSTE36	Dissertation Viva-Voce	**SDG 4, SDG 9, SDG 17**	Demonstrates independent research ability, collaboration, and contribution to sustainable infrastructure.

II. Professional Elective Courses (PEC)

S.No	Course Code	Course Name	Relevant SDGs	Justification
14	BSTE03	Analytical and Numerical Methods for Structural Engineering	**SDG 9**	Builds analytical and computational foundations for advanced structural design and simulation.
15	BSTE04	Special Concretes	**SDG 11, SDG 12**	Promotes use of eco-friendly, high-performance concretes for sustainable urban infrastructure.
16	BSTE05	Optimization Techniques	**SDG 9**	Enables efficient resource utilization and cost optimization in construction planning and design.
17	BSTE06	Reliability Analysis of Structures	**SDG 13**	Improves resilience and safety of structures against uncertain loads and environmental effects.
18	BSTE07	Theory of Plates and Shells	**SDG 9**	Enhances design competence for complex thin-walled structures used in modern infrastructure.
19	BSTE08	AI in Structural Engineering	**SDG 9, SDG 13**	Integrates Artificial Intelligence for predictive maintenance, optimization, and failure prevention.
20	BSTE09	Stability Analysis of Structures	**SDG 9**	Strengthens understanding of stability criteria and buckling analysis for tall and slender structures.
21	BSTE10	Design of Precast and Composite Structures	**SDG 11**	Encourages prefabrication for faster, cost-effective, and sustainable construction.
22	BSTE15	Design of Advanced Concrete Structures	**SDG 9**	Focuses on advanced design of concrete elements subjected to complex load conditions.
23	BSTE16	Design of High-Rise Structures	**SDG 11**	Promotes design of safe, sustainable vertical structures in urban environments.
24	BSTE17	Design of Masonry Structures	**SDG 11, SDG 12**	Encourages low-cost and sustainable construction using masonry technologies.
25	BSTE18	Bridge Engineering	**SDG 9**	Strengthens infrastructure connectivity through innovative bridge design and analysis.
26	BSTE19	Advanced Steel Design	**SDG 9**	Enables design of efficient, lightweight, and high-strength steel structures.
27	BSTE20	Design Concepts of Substructures	**SDG 11**	Focuses on geotechnical and foundation design for safe, durable building performance.
28	BSTE21	Design of Industrial Structure	**SDG 9**	Supports industrial development through design of safe, functional industrial structures.
29	BSTE22	Maintenance and Rehabilitation of Structures	**SDG 11, SDG 13**	Focuses on extending service life and resilience of existing structures under climate impacts.
30	BSTE26	Design of Prestressed Concrete Structures	**SDG 9**	Promotes innovative, material-efficient designs for long-span structures.
31	BSTE27	Introduction to Machine Learning and Deep Learning	**SDG 9**	Introduces ML/DL techniques for structural analysis, optimization, and predictive maintenance.
32	BSTE28	Theory of Plasticity and Fracture Mechanics	**SDG 13**	Analyzes material behavior under extreme stress and supports resilient design strategies.

33	BSTE29	Earthquake Resistant Design of Buildings	**SDG 11, SDG 13**	Promotes disaster-resilient design for earthquake-prone areas ensuring community safety.

III. Open Elective Courses (OEC)

S.No	Course Code	Course Name	Relevant SDGs	Justification
34	BSTE30	Cost Management of Engineering Projects	**SDG 9, SDG 12**	Promotes efficient project planning, budgeting, and sustainable resource management.
35	BSTE31	Waste to Energy	**SDG 7 , SDG 12**	Encourages circular economy principles by converting construction and municipal waste into energy.
36	BSTE32	Industrial Safety	**SDG 3**	Emphasizes workplace safety, accident prevention, and occupational health management.
37	BSTE33	Energy Efficient Buildings	**SDG 7 , SDG 11**	Promotes green building design principles to reduce energy consumption and environmental footprint.

IV. Audit Courses (AC)

S.No	Course Code	Course Name	Relevant SDGs	Justification / Contribution
38	BHSE02	English for Research Paper Writing	**SDG 4**	Enhances academic communication and research dissemination skills.
39	BHSE03	Disaster Management	**SDG 11, SDG 13**	Builds awareness for resilient communities and disaster risk reduction.
40	BHSE04	Sanskrit for Technical Knowledge	**SDG 4, SDG 11**	Promotes cultural integration in education and scientific understanding.
41	BHSE05	Value Education	**SDG 4, SDG 16**	Strengthens ethics, integrity, and responsible citizenship.
42	BHSE06	Constitution of India	**SDG 16**	Promotes justice, equality, and institutional responsibility.
43	BHSE07	Pedagogy Studies	**SDG 4**	Improves educational practices and learning methodologies.
44	BHSE08	Stress Management by Yoga	**SDG 3**	Promotes mental health, well-being, and stress resilience.
45	BHSE09	Personality Development through Life Enlightenment Skills	**SDG 3, SDG 4**	Develops emotional intelligence and holistic personal growth.

Sustainable Development Goals (SDGs)

1	No Poverty	2	Zero Hunger	3	Good Health and Well-Being
4	Quality Education	5	Gender Equality	6	Clean Water and Sanitation
7	Affordable and Clean Energy	8	Decent Work and Economic Growth	9	Industry, Innovation and Infrastructure
10	Reduced Inequalities	11	Sustainable Cities and Communities	12	Responsible Consumption and Production
13	Climate Action	14	Life Below Water	15	Life on Land
16	Peace, Justice and Strong Institutions	17	Partnerships for the Goals		

COURSE CONTENT

ADVANCED STRUCTURAL ANALYSIS								
I Semester: STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE01	Core	3	-	-	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

This course focuses on advanced methods of analyzing structural members and systems, extending beyond classical approaches. Students will explore unsymmetrical bending, curved beam behavior, beams on elastic foundations, and stability problems in columns. The course also emphasizes modern computational techniques such as stiffness and flexibility formulations, matrix methods, and the direct stiffness method for analyzing trusses, beams, and frames. It equips students with theoretical understanding and analytical tools essential for tackling complex structural engineering problems in practice and research.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The analysis of curved beams and beams supported on elastic foundations under different loading conditions.
II. The theories of column buckling with various end conditions, local effects, and inelastic behavior.
III. The fundamentals of stiffness and flexibility approaches in matrix methods of structural analysis.
IV. The formulation of stiffness matrices, load vectors, and coordinate transformations for structural members.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO 1 Explain the concept of shear center and analyze stresses and deflections in beams subjected to unsymmetrical bending.
CO 2 Examine circumferential and radial stresses in curved beams and analyze the response of beams resting on elastic foundations.
CO 3 Analyze the buckling behavior of columns under elastic, inelastic, and local instability conditions.
CO 4 Formulate stiffness and flexibility matrices for different structural elements and transform them between local and global coordinates.
CO 5 Assemble global stiffness matrices and solve for structural responses using matrix methods of analysis.
CO 6 Apply the direct stiffness method for analyzing trusses, beams, and frames in practical structural systems.

IV. COURSE CONTENT:

MODULE –I: UNSYMMETRICAL BENDING (9)
Definition of Shear Center in Bending - Symmetrical and Nonsymmetrical Bending - Bending Stresses in Beams Subjected to Nonsymmetrical Bending - Deflections of Straight Beams Subjected to Nonsymmetrical Bending.

MODULE -II: ADVANCED ANALYSIS OF BEAMS (9)
Curved Beams: Circumferential Stresses in a Curved Beam - Radial Stresses in Curved Beams - Correction of Circumferential Stresses in Curved Beams Having I, T or Similar Cross Sections - Deflections of Curved Beams Beams on Elastic Foundations - Infinite Beam Subjected to a Concentrated Load: Boundary Conditions - Infinite Beam Subjected to a Distributed Load Segment.

MODULE -III: COLUMN BUCKLING (9)
Concept of Column Buckling - Deflection Response of Columns to Compressive Loads

Euler Buckling of Columns with General End Constraints - Local Buckling of Columns - Inelastic Buckling of Columns

MODULE -IV: INTRODUCTION TO MATRIX METHODS OF ANALYSIS (9)
Static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force – displacement equations-Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates - Assembly of stiffness matrix from element stiffness matrix – Analysis of trusses, beams and frames by stiffness matrix methods.

MODULE -V: DIRECT STIFFNESS METHOD (9)
General procedure - banded matrix - semi bandwidth - assembly by direct stiffness matrix method -Application of direct stiffness method to trusses, simple and continuous beams and frames.

V. TEXTBOOKS:

1. C.S. Reddy, "*Basic Structural Analysis*", Tata McGraw-Hill, 3rd Edition, 2010.
2. R. Vaidyanathan & P. Perumal, "*Comprehensive Structural Analysis – Vol. I & II*", Laxmi Publications, 2005.
3. A. Ghose, "*Matrix Methods of Structural Analysis*", Prentice Hall of India, 1996.
4. W. Weaver & J.M. Gere, "*Matrix Analysis of Framed Structures*", CBS Publishers, 3rd Edition, 1990.

VI. REFERENCE BOOKS:

1. R.C. Hibbeler, "*Structural Analysis*", Pearson, 10th Edition, 2017.
2. Aslam Kassimali, "*Matrix Analysis of Structures*", Cengage Learning, 2nd Edition, 2011.
3. Devdas Menon, "*Advanced Structural Analysis*", Narosa Publishing, 2009.
4. M.L. Gambhir, "*Fundamentals of Structural Mechanics and Analysis*", PHI Learning, 2011.
5. B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, "*Structural Analysis*", Laxmi Publications, 16th Edition, 2017.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105101085
2. https://nptel.ac.in/courses/105101086
3. https://nptel.ac.in/courses/105106050

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes

7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

THEORY OF ELASTICITY AND PLASTICITY								
I Semester: STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE02	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

This course introduces the principles of elasticity, components of stresses and strains, differential equations of equilibrium, boundary conditions, compatibility conditions and stress function. This course also covers the two-dimensional problems in rectangular coordinates and polar coordinates, Fourier series for two-dimensional problems stress distribution symmetrical about an axis, pure bending of curved bars, strain components in polar coordinates, displacements for symmetrical stress distributions, simple symmetric and asymmetric problems, analysis of stress strain in three dimensions, torsion of prismatic bars and plasticity.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Stress–strain relations and the governing equations of elasticity in two and three dimensions, including equilibrium, compatibility, and boundary conditions.
II. Mathematical formulations such as stress functions, Fourier series, and polynomial solutions to analyze two-dimensional problems in rectangular and polar coordinates.
III. The state of stress and strain in three dimensions, determine principal stresses and strains, and employ general theorems such as uniqueness, reciprocal theorem, and superposition for solving structural problems.
IV. Torsional and bending behavior of prismatic bars with different cross-sections and study plasticity models, yield criteria, and stress–strain relationships for materials beyond the elastic range.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO 1 Explain the fundamental concepts of elasticity, including stress–strain components, strain–displacement relations, Hooke's law, and governing equations for plane stress and plane strain problems.
CO 2 Apply mathematical methods such as polynomial solutions and Fourier series to solve two-dimensional problems in rectangular and polar coordinates, including stress distributions, beam bending, and gravity loading.
CO 3 Analyze the state of stress and strain in three dimensions, determine principal stresses and strains, and evaluate compatibility and equilibrium conditions for structural elements.
CO 4 Explain and apply general theorems of elasticity such as superposition, uniqueness, reciprocal theorem, and equilibrium equations to solve boundary value problems.
CO 5 Evaluate torsional and bending behavior of prismatic bars with various cross-sections using stress function, energy methods, and analogies for structural design applications.
CO 6 Demonstrate an understanding of plasticity concepts, yield criteria, and stress–strain models to analyze structures beyond the elastic range for safe and efficient design.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION TO PLANE STRESS AND PLANE STRAIN ANALYSIS (09)
Elasticity – Notation for Forces and Stresses-Components of Stresses-Components of Strain, Hooke's Law. Plane Stress, Plane Strain, Differential Equations of Equilibrium, Boundary Conditions, Compatibility Equations, Stress Function, Boundary Conditions.

MODULE - II: TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES (10)
Two dimensional problems in rectangular coordinates, solution by polynomials, St. Venant's principle, determination of displacements, bending of simple beams, application of Fourier series for two dimensional problems, gravity loading. Two dimensional problems in polar coordinates, stress distribution symmetrical about an axis, pure bending of curved bars, strain components in polar coordinates, displacements for symmetrical stress distributions, simple symmetric and asymmetric problems, general solution of two-dimensional problems in polar coordinates, application of general solution in polar coordinates.

MODULE - III: ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS (09)
Analysis of stress and strain in three dimensions, principal stresses, stress ellipsoid, director surface, determination of principal stresses, max shear stresses, homogeneous deformation, and principal axes of strain rotation.

General theorems: Differential equations of equilibrium, conditions of compatibility, determination of displacement, equations of equilibrium in terms of displacements, principle of super position, uniqueness of solution, the reciprocal theorem.

MODULE - IV: TORSION OF PRISMATICAL BARS (9)
Torsion of prismatic bars, bars with elliptical cross sections, other elementary solution, membrane analogy, torsion of rectangular bars, solution of torsion problems by energy method, use of soap films in solving torsion problems, hydro dynamical analogies, torsion of shafts, tubes, bars etc. Bending of prismatic bars: Stress function, bending of cantilever, circular cross section, elliptical cross section, rectangular cross section, bending problems by soap film method, displacements.

MODULE - V: THEORY OF PLASTICITY (8)
Theory of Plasticity: Introduction, concepts and assumptions, idealized stress train behavior, Elastic perfectly plastic material, perfectly plastic material, linearly strain hardening material, power law stress train model, strain hardening, nominal and true stress strain, yield criterions.

V. TEXTBOOKS:

1. C.S. Reddy, "*Basic Structural Analysis*", Tata McGraw-Hill, 3rd Edition, 2010.
2. R. Vaidyanathan & P. Perumal, "*Comprehensive Structural Analysis – Vol. I & II*", Laxmi Publications, 2005.
3. A. Ghose, "*Matrix Methods of Structural Analysis*", Prentice Hall of India, 1996.
4. W. Weaver & J.M. Gere, "*Matrix Analysis of Framed Structures*", CBS Publishers, 3rd Edition, 1990.

VI. REFERENCE BOOKS:

1. R.C. Hibbeler, "*Structural Analysis*", Pearson, 10th Edition, 2017.
2. Aslam Kassimali, "*Matrix Analysis of Structures*", Cengage Learning, 2nd Edition, 2011.
3. Devdas Menon, "*Advanced Structural Analysis*", Narosa Publishing, 2009.
4. M.L. Gambhir, "*Fundamentals of Structural Mechanics and Analysis*", PHI Learning, 2011.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105101085
2. https://nptel.ac.in/courses/105101086
3. https://nptel.ac.in/courses/105106050

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II

6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE03	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Mathematical Transform Techniques								

I. COURSE OVERVIEW:

Numerical methods provide a way to solve problems quickly and easily compared to analytic solutions. Whether the goal is integration or solution of complex differential equations, there are many tools available to reduce the solution of what can be sometimes quite difficult analytical math to simple algebra. Analysis, modeling and solution of realistic engineering problems. Learning outcome looks at algebraic methods, including polynomial division, exponential, trigonometric and hyperbolic functions, arithmetic and geometric progressions in an engineering context and expressing variables as power series.

II. COURSE OBJECTIVES:

The student will try to learn:

I. Formulation of the mathematical model of the problem to solve civil engineering problems
II. Partial differential equations with closed form or numerical solution in structural mechanics using numerical methods.
III. The applications of mathematical tools and statistical methods for the solution of the problems related to structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Analyze different types of numerical errors and apply interpolation, extrapolation, and curve fitting techniques for engineering problem solving.

CO 2 Apply numerical methods to solve nonlinear algebraic and transcendental equations with accuracy and convergence analysis.

CO 3 Formulate and solve systems of linear equations and eigenvalue problems using concepts of matrix algebra.

CO 4 Evaluate shear forces, bending moments, and deflections in beams using numerical differentiation and integration techniques.

CO 5 Implement finite difference schemes for solving ordinary and partial differential equations, and assess the stability of explicit and implicit methods.

CO 6 Design computer algorithms for structural engineering problems and explore the role of fuzzy logic and neural networks in numerical analysis.

IV. COURSE CONTENT:

MODULE - I: FUNDAMENTALS OF NUMERICAL METHODS (09)
Error Analysis, Polynomial Approximations and Interpolations, Curve Fitting**;** Interpolation and extrapolation Solution of Nonlinear Algebraic and Transcendental Equations.

MODULE - II: ELEMENTS OF MATRIX ALGEBRA (09)
Solution of Systems of Linear Equations, Eigen Value Problems

MODULE - III: NUMERICAL DIFFERENTIATION & INTEGRATION (9)
Numerical integration (Trapezoidal and Simpson's rule) for determining shear, moment and deflection in beams

Gauss Quadrature formula for Numerical integration (Trapezoidal and Simpson's rule), Solution of ordinary and Partial Differential Equations.

MODULE - IV: FINITE DIFFERENCE SCHEME (9)
Implicit & Explicit scheme, solution using Explicit method, Stability analysis of Explicit and Implicit scheme

MODULE - V: COMPUTER ALGORITHMS (9)
Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

V. TEXTBOOKS:

1. Atkinson K. E., "*An Introduction to Numerical Analysis*", J. Wiley and Sons, 1989.
2. Stevan C. Chopra, Raymond P. Canal, "*Numerical Methods for Engineers*", Mc Graw Hill Book Company. April 2009.

VI. REFERENCE BOOKS:

1. Scheid F, "*Theory and Problems of Numerical Analysis*", McGraw Hill Book Company, (ShaumSeries), 1988.
2. Sastry S. S, "*Introductory Methods of Numerical Analysis*", Prentice Hall of India, 1998

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105105043/
2. https://www.class-central.com/course/nptel-numerical-methods-finite-difference-approach-10003
3. https://nptel.ac.in/courses/105/105/105105043/

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

SPECIAL CONCRETES								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE04	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Concrete Technology								

I. COURSE OVERVIEW:

The Special Concretes course provides an in-depth understanding of advanced concrete types and their applications beyond conventional mixes. It covers various specialized concretes, including high-strength, self-compacting, fiber-reinforced, lightweight, mass, shotcrete, preplaced aggregate, underwater anti-washout, and micro-concretes. The course emphasizes the properties, mix design, construction techniques, and quality control measures required for these concretes under diverse environmental and structural conditions. It also highlights practical applications in high-rise buildings, massive infrastructure, underwater structures, and extreme weather conditions, equipping students and professionals with the knowledge to select and apply suitable concrete types for complex engineering projects.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The design, manufacturing, and applications of high-strength, high-performance, and special concretes.
II. Skills to design concrete mixes using BIS and international methods for different construction needs.
III. Formwork materials, design requirements, erection, maintenance, and failure prevention techniques.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Identify and select suitable concrete-making materials based on BIS specifications and project requirements.
CO 2 Conduct and interpret tests on fresh and hardened concrete to evaluate workability, strength, and durability.
CO 3 Understand the microstructure and mechanical properties of High Strength Concrete (HSC) and Ultra High Strength Concrete (UHSC).
CO 4 Design and optimize high-strength, high-performance, and special concretes for specific applications.
CO 5 Prepare detailed concrete mix designs using IS 10262:2019 and DOE methods to meet quality targets.
CO 6 Design safe, efficient formwork systems and apply best practices for installation, reshoring, and removal.

IV. COURSE CONTENT:

MODULE-I: Concrete Making Materials (09)
Cement – Bogus Compounds, Hydration Process, Types of Cement, Aggregates – Gradation Charts, Combined Aggregate, Alkali Silica Reaction, Admixtures - Chemical and Mineral Admixtures. Bureau of Indian Standards (BIS) Provisions.

MODULE-II: Fresh and Hardened Concrete (09)
Fresh Concrete – workability tests on Concrete, Setting Times of Fresh Concrete, Segregation and bleeding. Hardened Concrete: Abrams Law, Gel space ratios, Maturity concept, Stress strain Behaviour, Creep and Shrinkage, Durability Tests on Concrete, Non-Destructive Testing of Concrete. BIS Provisions.

MODULE-III: High Strength Concrete and High-Performance Concrete (9)
High Strength Concrete – Microstructure, Manufacturing and Properties, Design of HSC Using Erintroy Shaklok method, Ultra High Strength Concrete.

High Performance Concrete –Requirements and Properties of High-Performance Concrete, Design Considerations. BIS Provisions.

MODULE-IV: Special Concretes and Mix Design (10)
Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete, Reactive Powder Concrete, Requirements and Guidelines, Advantages and Applications.
Concrete Mix Design: Quality Control, Quality Assurance, Quality Audit, Mix Design Method, BIS Method IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method, Light Weight Concrete, Self-Compacting Concrete.

MODULE-V: Form work (8)
Form work, materials, structural requests, form work systems, connections, specifications, design of form work, shores, removal for forms, shores, reshoring, failure of form work.

V. TEXTBOOKS:

1. A. M. Neville, "*Properties of Concrete*", ELBS publications, 2012.
2. A. K. Santha kumar, "*Concrete Technology*", Oxford Press, 2006.
3. M. S. Shetty, "*Concrete Technology*", S. Chand & Co, 2006.

VI. REFERENCE BOOKS:

1. Rajat Siddique, "*Special Structural Concretes*", Galgotia Publications, 2004.
2. N. Krishna Raju, "*Design of Concrete Mixes*", CBS Publications, 1996.
3. P. K. Mehta, "*Concrete: Microstructure*", ICI, Chennai, 2007

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/112104160/3
2. http://nptel.ac.in/downloads/112104160/
3. https://books.google.co.in/books?id=DXOsGoqtiggC&printsec=frontcover#v=onepage&q&f=false.
4. https://www.researchgate.net/publication/273059503_Introduction_to_Structural_Health_Monitoring

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

OPTIMIZATION TECHNIQUES								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE05	**Elective**	3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Linear Algebra and Calculus								

I. COURSE OVERVIEW:

Optimization Techniques is an advanced course designed to equip students with the theoretical foundations, computational methods, and practical applications of optimization in structural engineering. The course emphasizes the systematic development of efficient, safe, and sustainable structural systems by integrating engineering principles with optimization algorithms. Students will be introduced to classical optimization methods, modern metaheuristic approaches, and computational tools widely applied in solving structural design problems. The course covers both deterministic and stochastic optimization methods, focusing on real-world applications in civil structures

II. COURSE OBJECTIVES:

The student will try to learn:

I. The principles of structural optimization and be able to solve them analytically.
II. Structural optimization problems in the framework of calculus of variations as well as finite-variable optimization.
III. Contemporary literature on structural optimization in general and topology optimization in particular.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Formulate structural engineering problems into optimization models by identifying design variables, objective functions, and constraints.
CO 2	Apply classical optimization methods (linear, nonlinear, and integer programming) to solve structural design problems.
CO 3	Analyze structural optimization problems using gradient-based and numerical approaches.
CO 4	Implement metaheuristic algorithms such as Genetic Algorithms, Particle Swarm Optimization, and Ant Colony Optimization for complex structural systems.
CO 5	Evaluate alternative structural designs based on weight, cost, safety, and sustainability criteria.
CO 6	Develop and validate computational optimization models using MATLAB, Python, or specialized structural analysis/optimization software.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION (09)
Definition, Variables, Objective Function, Constraints, Simultaneous Failure Mode and Design, Classical External Problems

MODULE - II: CALCULUS OF VARIATION (09)
Differential calculus, Optimality criteria, Vibrational Principles with Constraints, Single variable optimization Multivariable optimization

MODULE – III: LINEAR PROGRAMMING (10)
Integer Programming, Nonlinear Programming, Dynamic Programming, Geometric Programming and Stochastic Programming.

Problem formulation, Graphical solution, Analytical method, Standard form, Slack, surplus and artificial variables

MODULE - IV: APPLICATIONS (9)
Structural Steel and Concrete Members, Trusses and Frames, Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory

MODULE - V: DESIGN (9)
Frequency Constraint, Design of Layouts, Minimum weight design for truss members, Fully stressed design-Optimization principles to design of R.C. structures such as multi-storey buildings.

V. TEXT BOOKS:

1. Spillers, William R, Keith M. MacBain, "*Structural Optimization*", Springer, 2009.
2. M. P. Bendsoe, O. Signmund,"*Topology Optimization: Theory, methods and Applications*" Springer, 2003

VI. REFERENCE BOOKS:

1. Haftka, Raphael T., Gürdal, Zafer, "*Elements of Structural Optimization*", Third Revised and Expanded Edition, kluver academic publishers, 2012.
2. Andrej Cherkaev, "*Variational methods for Structural Optimization*", Springer, 2012.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/112108211/25
2. http://nptel.ac.in/courses/112108211/25

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

RELIABILITY ANALYSIS OF STRUCTURES								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE06	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

This course focuses on assessing and quantifying the safety and performance of civil and structural engineering systems under uncertain conditions. It introduces probabilistic concepts, random variables, and statistical methods applied to structural loads, material properties, and environmental factors. The course covers reliability-based design principles, limit state functions, safety indices, and reliability evaluation techniques such as the First-Order Reliability Method (FORM) and Monte Carlo simulations. By integrating theory with practical applications, students learn to evaluate structural safety, optimize designs under uncertainty, and make informed decisions for risk-sensitive engineering projects.

II. COURSE OBJECTIVES:

The student will try to learn:

I. To acquire basic knowledge of Statistics and Probability Theory
II. To understand resistance distribution and parameters
III. To develop the ability to do computation of structural reliability
IV. To understand reliability design criteria

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Understand the fundamental concepts of structural safety, application of basic statistics and probability theory for solving engineering problems.
CO 2 Analyze statistical properties of construction materials for determining allowable stresses based on reliability considerations.
CO 3 Apply Monte Carlo simulation techniques for assessing structural reliability and evaluate the probability of failure in structural systems.
CO 4 Utilize reliability methods including First-Order Second-Moment (FOSM) and failure surface analysis for computing structural reliability indices.
CO 5 Develop reliability-based design criteria by determining partial safety factors and optimal safety factors for reinforced concrete structures.
CO 6 Integrate reliability concepts with Indian Standard codes for reliability-based design, and optimization of RCC structures.

IV. COURSE CONTENT:

MODULE-I: Concepts of Structural Safety (09)
General, Design methods, Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation, Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, common probability distribution, Extremal distribution.

MODULE-II: Resistance Distributions and Parameters (09)
Introduction, Statistics of properties of concrete, steel, strength of bricks and mortar, dimensional variations, characterization of variables, Allowable stresses based on specified reliability.

MODULE-III: Basic Structural Reliability (09)
Introduction, Computation of Structural reliability, Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications.

MODULE-IV: Reliability Methods (9)
Introduction, Basic variables and failure surface, First-order second-moment methods (FOSM)

MODULE-V: Reliability Based Design (9)
Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability, based design criteria, Optimal safety factors, Summary of results of study for Indian standard, RCC Design.

V. TEXTBOOKS:

1. R. Ranganathan, "*Structural Reliability Analysis and Design"*, Jaico Publishing House, 2006.
2. R.E. Melchers, "*Structural Reliability – Analysis & Prediction*", Wiley – Blackwell, 1999.

VI. REFERENCE BOOKS:

1. Maurice Lemaire, *"Structural Reliability*", Wiley, 2009.
2. Dan M. Frangopol, Mitsuo Kawatani & Chul-Woo Kim, "*Reliability and Optimization of Structural Systems"*, Taylor & Francis, 2006.

VII. ELECTRONICS RESOURCES:

1. https://www.youtube.com/watch?v=Lm0BrtI4LE8
2. https://nptel.ac.in/courses/105103140

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

THEORY OF PLATES AND SHELLS								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE07	Elective	3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Analysis of Structures								

I. COURSE OVERVIEW:

Plates and shells represent thin-walled structural elements that exhibit two-dimensional action, resulting in lightweight, efficient, and economical structural systems with high strength-to-weight ratios. This course introduces the fundamental theories and governing equations of plate bending in rectangular and circular geometries, solution methods such as Navier's and Levy's approaches, and behavior of plates on elastic foundations under various loading conditions. It also covers the analysis of cylindrical shells and shells of double curvature using membrane and bending theories, with applications to practical engineering forms such as domes, cooling towers, roofs, and shell-type structures. Completion of this course provides essential knowledge for understanding the behavior and design of thin plate and shell structures widely used in modern engineering practice.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The governing differential equations for bending of thin rectangular and circular plates, and apply analytical methods such as Navier's and Levy's solutions to solve practical loading problems.
II. The theory of large deflections in plates, and evaluate the effects of concentrated and distributed loads for efficient and economical structural design.
III. Mathematical formulations to analyze plates resting on elastic foundations under different loading conditions using closed-form solutions and approximation techniques.
IV. The geometry, membrane and bending theories of cylindrical and double-curvature shells, and apply them to the analysis and design of engineering structures such as domes, roofs, and cooling towers.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Analyze the bending behavior of thin rectangular plates and solve governing differential equations using Navier's and Levy's methods under distributed and concentrated loads.
CO 2 Formulate and explain the governing differential equations for circular and annular plates in polar coordinates, and evaluate their response under symmetric and eccentric loading.
CO 3 Apply the theory of large deflections in plates to assess bending and stretching effects for efficient and economical structural design.
CO 4 Examine the governing differential equations for plates resting on elastic foundations and solve practical problems using Navier- and Levy-type solutions.
CO 5 Explain the geometry, stress resultants, and bending theory of cylindrical shells, and apply simplified methods for analysis and design.

CO 6 Understand and analyze shells of double curvature and axi-symmetrical shells using membrane theory, with applications to domes, roofs, and cooling towers.

IV. COURSE CONTENT:

MODULE-I: THIN RECTANGULAR PLATES (9)
Bending of thin plates, assumptions, governing differential equations in Cartesian coordinate system, Boundary conditions, analytical solutions for rectangular plates by Navier and Levy's methods, distributed and concentrated loads.

MODULE-II: CIRCULAR PLATES (09)
Circular plates: Governing differential equations in polar coordinate system, annular plate, rotationally symmetric loading, eccentric concentrated load, simultaneous bending and stretching of thin plates, introduction to large deflection theory of plates.

MODULE-III: PLATES ON ELASTIC FOUNDATIONS (9)
Plates on elastic foundations, governing differential equation and deflection of uniformly loaded simply supported rectangular plate.

Navier and Levy type solutions, large plate loaded at equidistant points by concentrated forces.

MODULE-IV: SHELLS (09)
Shells, geometry and classifications, stress resultants, membrane theory and its applications to shells of surface of revolutions, membrane theory for cylindrical shell, general theory in bending of cylindrical shell, simplified method for cylindrical shell.

MODULE-V: INTRODUCTION TO SHELLS OF DOUBLE CURVATURE (10)
Geometry, analysis, and design of elliptic paraboloid, conoid, and hyperbolic paraboloid shapes, including inverted umbrella type.
Axi-Symmetrical Shells:
General equation – Analysis of axi-symmetrical shells by membrane theory – Application to spherical shells and hyperboloid of revolution cooling towers.

V. TEXTBOOKS:

1. Timoshenko S. and Krieger, "*Theory of Plates and Shells*", W. McGraw Hill, 1959.
2. Chandra shekhara. K, "*Theory of Plates*", Universities Press, 2001.
3. Timoshenko, "*Theory of Plates and Shells*", Tata MC Graw Hill, 1959.

VI. REFERENCE BOOKS:

1. UguralAnselC, "*Stresses in Plates and Shells"*, McGraw Hill, 2009.
2. Kraus.H, "*Thin Elastic Shells*", John Wiley and Sons, 1998.
3. Rama swamy. G. S., "*Design and Construction of Concrete Shells*", 2001.

VII. ELECTRONICS RESOURCES:

1. https://pdfs.semanticscholar.org/presentation/ce6d/b61238325d60d3f6dc0f1fbe7af33e397 2c1.pdf
2. https://ocw.mit.edu/courses/mechanical-engineering/2-081j-plates-and-shells-spring-2007/readings/lecturenote.pdf.
3. http://community.wvu.edu/~bpbettig/MAE456/Lecture_10_Shell_Elements_b.pdf

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I

5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

AI IN STRUCTURAL ENGINEERING								
I Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE08	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Probability and Statistics								

I. COURSE OVERVIEW:

This course introduces the principles of Artificial Intelligence (AI) and its integration into civil engineering applications. It covers intelligent agents, search techniques, machine learning models, supervised and unsupervised learning methods, with a focus on how these techniques can solve real-world civil engineering problems such as structural health monitoring, construction optimization, transportation systems, and material performance prediction. The course bridges theory and practice, enabling students to apply AI tools for resilient, efficient, and sustainable civil engineering solutions.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals, scope, and challenges of AI in civil engineering applications.
II. The problem-solving skills using search algorithms for optimization and planning in civil engineering systems.
III. Supervised and unsupervised learning models and their role in engineering decision-making.
IV. Machine learning techniques for prediction, classification, and clustering in civil engineering domains.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the fundamental concepts, history, and applications of AI in civil engineering.
CO 2 Identify suitable intelligent agents and search strategies for solving civil engineering optimization problems.
CO 3 Apply supervised learning models such as regression, decision trees, SVM, and neural networks to predict and classify engineering data.
CO 4 Utilize unsupervised learning techniques such as PCA and clustering for analyzing and interpreting civil engineering datasets.
CO 5 Compare different AI models in terms of performance, bias-variance trade-off, and suitability for engineering applications.
CO 6 Analyze case studies of AI applications in structural, geotechnical, transportation, and construction engineering to propose effective solutions.

IV. COURSE CONTENT:

MODULE –I: INTELLIGENT AGENT AND UNINFORMED SEARCH (9)

Introduction - Foundations of AI - History of AI - The state of the art - Risks and Benefits of AI - Intelligent Agents - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems - Uninformed Search - Breadth First Search - Dijkstra's algorithm or uniform cost search - Depth First Search - Depth Limited Search. Applications: Structural layout optimization, Pathfinding in construction planning, Bridge inspection routing, Preliminary design space exploration.

MODULE -II: PROBLEM SOLVING WITH SEARCH TECHNIQUES (9)

Informed Search - Greedy Best First - A* algorithm - Adversarial Game and Search - Game theory - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning. Applications: Optimized design, Decision-making in retrofitting, Construction scheduling.

MODULE -III: LEARNING (9)

Machine Learning: Definitions – Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation,

Concept of over fitting, under fitting, Bias and Variance - Regression: Linear Regression - Logistic Regression, Applications: Structural health monitoring, Material strength prediction, Load prediction, perform prediction.

MODULE -IV: SUPERVISED LEARNING (9)

Neural Network: Introduction, Perceptron Networks – Adaline - Back propagation networks - Decision Tree: Entropy – Information gain - Gini Impurity - classification algorithm - Rule based Classification - Naïve Bayesian classification - Support Vector Machines (SVM), applications: Predicting nonlinear stress-strain behavior, Failure mode classification in beams and slabs.

MODULE -V: UNSUPERVISED LEARNING (9)

Unsupervised Learning – Principle Component Analysis - Neural Network: Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps – Clustering: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm, applications: Grouping buildings, Grouping structural health monitoring, Visualizing patterns in structural damage data.

V. TEXTBOOKS:

1. S. Russell and P. Norvig, "*Artificial Intelligence: A modern approach*", Prentice Hall, Fourth Edition, 2021.
2. S.N. Sivanandam and S.N. Deepa, "*Principles of soft computing*" Wiley India, 3rd edition, 2018.
3. Manuel Duarte Pinheiro, Hugo Rodrigues, "*Machine Learning, Data Science, and Artificial Intelligence Applied to Structural Engineering*", Springer, 2022.
4. Satish Chandra, Mithilesh Kumar, "*Big Data Analytics in Structural Dynamics: Fundamentals and Applications*", CRC Press, 2021.

VI. REFERENCE BOOKS:

1. Tom Mitchell, "*Machine Learning*", McGraw- Hill, 1st Edition 2017.
2. C. Muller and Sarah Alpaydin, Ethem, "*Introduction to machine learning*", MIT press, 2020.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/106106139
2. https://nptel.ac.in/courses/106102220

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank

3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

STABILITY ANALYSIS OF STRUCTURES								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE09	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Analysis of Structures								

I. COURSE OVERVIEW:

Structural stability is a fundamental requirement in the safe and efficient design of engineering structures. This course introduces the concepts of stability, strength, and stiffness, and develops the classical criteria for analyzing discrete and continuous systems under linear and nonlinear behavior. It covers the elastic buckling of columns and beam–columns under various loading and boundary conditions, including the effects of eccentricity, shear, and elastic foundations. The stability of frames is examined with emphasis on member versus global buckling and slenderness considerations. Further, the course explores the lateral torsional buckling of beams and the buckling of thin plates under axial, shear, and combined loading conditions, including inelastic and dynamic stability effects. Completion of this course equips students with the analytical tools necessary to evaluate and design stable structural systems used in modern engineering practice.

II. COURSE OBJECTIVES:

The student will try to learn:

I. Explain the fundamental concepts of stability, strength, and stiffness, and apply stability criteria to discrete and continuous structural systems under linear and nonlinear behavior.
II. Analyze the elastic buckling of bars and columns under different loading and support conditions using classical and energy methods, including the effects of shear, eccentricity, and variable cross-sections.
III. Evaluate the stability of structural frames by distinguishing between member buckling and global buckling and determine critical loads using differential equations and slenderness ratio concepts.
IV. Examine the lateral torsional buckling of beams and the buckling behavior of plates under axial, shear, and combined loads, including inelastic and dynamic stability effects.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Explain the fundamentals of stability, strength, and stiffness, and apply stability criteria to discrete and continuous systems under linear and nonlinear behavior.
CO 2	Analyze the elastic buckling of columns under axial, eccentric, and lateral loading using both classical and energy methods
CO 3	Evaluate the behavior of beam–columns and bars on elastic foundations, and determine critical loads under varying loading and cross-sectional conditions.
CO 4	Assess the stability of structural frames by distinguishing between member buckling and global buckling, and apply differential equation and slenderness ratio methods to compute critical loads.
CO 5	Analyze the lateral torsional buckling of beams under different boundary and loading conditions, and apply approximate and exact methods for determining buckling strength.
CO 6	Examine the buckling of thin plates under axial, shear, and combined loads, including the effects of inelastic behavior and dynamic stability

IV. COURSE CONTENT:

MODULE - I: CRITERIA FOR DESIGN OF STRUCTURES (09)
Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behavior.

MODULE - II: ELASTIC BUCKLING OF BARS (9)
Elastic Buckling of Straight Columns –Effect of Shear Stress on Buckling-Eccentrically and Laterally Loaded Columns –Energy Methods –Buckling of A Bar on Elastic Foundation, Buckling of A Bar With Intermediate Compressive Forces and Distributed Axial Loads –Buckling of Bars With Change in Cross Section –Effect of Shear Force on Critical Load – Built Up Columns.

MODULE - III: STABILITY OF FRAMES (10)
Introduction, modes of buckling, Member Buckling versus Global Buckling, critical load using various methods.

Differential equation buckling, Relative slenderness, Slenderness Ratio of Frame Members.

MODULE - IV: STABILITY OF BEAMS (8)
Lateral torsion buckling, Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

MODULE - V: STABILITY OF PLATES (09)
Axial flexural buckling, shear flexural buckling, buckling under combined Loads. Introduction to Inelastic Buckling and Dynamic Stability.

V. TEXTBOOKS:

1. Timoshenko and Gere, "*Theory of elastic stability*", Tata McGraw Hill,1981.
2. Alexander Chajes, "*Principles of Structural Stability Theory*", Prentice Hall, New Jersey, 1992.

VI. REFERENCE BOOKS:

1. Iyengar, N. G. R, "*Structural Stability of columns and plates*", Eastern west press Pvt. Ltd, 1996.
2. Bleich F. Bucking, "*Strength of Metal Structures*", Tata McGraw Hill, New York, 2001.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105106116/10
2. https://www.colorado.edu/engineering/CAS/courses.d/Structures.d/IAST.Lect23.d/IAST.Lect23.Slides.pdf

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

DESIGN OF PRECAST AND COMPOSITE STRUCTURES								
I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE10	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Design of Reinforced Concrete Structures								

I. COURSE OVERVIEW:

The course Design of Precast and Composite Structures introduces students to modern methods of construction that combine efficiency, durability, and sustainability. Precast concrete and steel–concrete composite systems are increasingly used in high-rise buildings, industrial structures, bridges, and large-span facilities due to their structural efficiency, quality control, and faster construction cycles. It emphasizes codal provisions (IS and international codes), detailing requirements, and construction practices essential to ensure safety, stability, and structural integrity.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts and techniques of precast construction systems.
II. Various precast structural elements (floors, beams, columns, walls, connections) tailored to safety and integrity.
III. The design of composite steel–concrete elements such as composite floors and beams with a focus on behavior, serviceability, and ultimate strengths.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the principles, advantages, and limitations of precast and composite construction systems.
CO 2 Analyze and design precast floor systems, beams, columns, and wall panels under various loading conditions.
CO 3 Design and detail structural connections in precast construction to ensure safety, integrity, and continuity.
CO 4 Apply codal provisions (IS codes and international standards) in the design of precast and composite structural elements.
CO 5 Design steel–concrete composite floors and beams considering serviceability, strength, and vibration criteria.
CO 6 Integrate sustainability, prefabrication efficiency, and modern construction practices in precast and composite structural design.

IV. COURSE CONTENT:

MODULE –I: PRECAST FLOOR SYSTEMS (9)
Introduction to precast construction: need, advantages, modular coordination; Types of precast structural systems and elements; Design of precast floors: hollow-core slabs, precast planks, composite topping (with and without props); Structural behavior under gravity and lateral loads.

MODULE -II: PRECAST BEAMS, COLUMNS, AND WALLS (9)
Design of precast reinforced and prestressed beams: propped/un-propped conditions, nibs, bridging members; Precast columns with corbels: braced and unbraced conditions; Design of precast walls under vertical/horizontal loads and moments; Joint detailing, vertical ties, and stability considerations.

MODULE -III: PRECAST CONNECTIONS AND INTEGRITY (10)
Classification of connections: simple, semi-rigid, and rigid; Beam–column connections, steel inserts, sockets, and welded joints.

Ensuring continuity and robustness of precast structures; Design measures against progressive collapse, including structural ties and redundancy.

MODULE -IV: COMPOSITE FLOORS (10)
Behavior and design of steel–concrete composite floor systems; Profiled sheeting with concrete topping: methods of design, shear bond, bending and shear resistance; Serviceability checks: deflection, cracking, and vibration criteria; Example problems on composite slab systems.

MODULE -V: COMPOSITE BEAMS (10)
Elastic and ultimate load behavior of composite beams; Stress distribution and deflection in service; Design of simply supported composite beams with codal provisions; Detailing requirements for shear connectors and reinforcement.

V. TEXTBOOKS:

1. R. P. Johnson, "*Composite Structures of Steel and Concrete (Vol. I)",* Blackwell Scientific Publications, 2nd Edition, U.K., 1994
2. S. Rama chandramurthy, "*Design & Construction of Precast Structures"*, Dipti Press, Chennai, 2012

VI. REFERENCE BOOKS:

1. Hubert Bachmann & Alfred Steinle, "*Design of Precast Concrete Structures"*, Ernst & John Publications,1999
2. David Sheppard, *Plant Cast, Precast and Prestressed Concrete*, McGraw Hill, 1989

VII. ELECTRONICS RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_ce89/preview
2. https://nptel.ac.in/courses/112103308

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

ADVANCED CAD LABORATORY								
I Semester: STE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE11	Core	0	0	4	2	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Computer Aided Engineering Drawing								

I. COURSE OVERVIEW:

Advanced CAD Lab focuses on the application of computer-aided design tools for the modeling, analysis, and detailing of civil engineering structures. This course provides hands-on experience with advanced CAD software to develop 2D drawings, 3D models, and structural detailing in line with industry standards and codes. It emphasizes precision, efficiency, and innovation by integrating drafting techniques, parametric modeling, and visualization tools for structural engineering applications. The lab also explores interoperability with analysis software, automated detailing, and preparation of construction-ready drawings to enhance design accuracy, productivity, and professional practice in structural engineering.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals of computer-aided design tools, drafting standards, and modeling principles for understanding their role in structural engineering applications.
II. Civil engineering components and structural systems using 2D drafting, 3D modeling, and parametric design features for improving accuracy and efficiency in design documentation.
III. Advanced CAD techniques for structural detailing, interoperability with analysis software, and preparation of construction-ready drawings in compliance with industry codes and standards.
IV. Case studies and practical projects using CAD software for identifying best practices, challenges, and innovative approaches in digital design and drafting for civil engineering structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Design basic structural elements like slabs, beams, columns and stair cases etc. for construction purpose.
CO 2 Analyze technical drawings using both CAD and basic manual tools.
CO 3 Develop the drawings of structural elements for different applications.
CO 4 Build the different stages of the structure from scratch using engineering graphics techniques such as sectional projections, dimensioning and computer-generated drawings.
CO 5 Make use of software packages for creating different structural Geometry.
CO 6 Apply principles of technical drawings for producing different 3D models.

IV. COURSE CONTENT:

Week –I: DESIGN OF SLABS
Analysis and design of continuous slab & development of Excel template

Week –II: DESIGN OF DETERMINATE BEAMS
Analysis and design of determinate beams & development of Excel template

Week –III: DESIGN OF INDETERMINATE BEAMS
Analysis and design of indeterminate beams & development of Excel template

Week –IV: DESIGN AND DETAILING OF CONTINUOUS BEAMS
Analysis and design of continuous beams & development of Excel template

Week –V: DESIGN OF COLUMN USING CAD
Analysis and design of columns & development of Excel template

Week-VI: DESIGN OF FOOTING USING EXCEL
Analysis and design of footing & development of Excel template

Week-VII: DESIGN OF STAIRCASE USING EXCEL
Analysis and design of staircase & development of Excel template

Week-VIII: DESIGN OF PLANE FRAMES
Analysis and design of plane frames and development of Excel template.

Week-IX: DESIGN OF SPACE FRAMES
Analysis and design of space frames and development of Excel template.

Week-X: DESIGN OF MULTISTORIED BUILDING SUBJECTED TO DL, LL and WL
Analysis and design of a multistoried building subjected to DL, LL and WL

Week-XI: DESIGN OF MULTISTORIED BUILDING SUBJECTED TO DL, LL and EQ
Analysis and design of a multistoried building subjected to DL, LL and EQ

Week-XII: DESIGN OF ROOF TRUSSES INCLUDING WL
Analysis and design of Roof trusses including WL calculation in Excel Spreadsheet

Week-XIII: DESIGN OF GANTRY GIRDER
Analysis and design of Gantry girder and development of spread sheet

Week-XIV: 3D MODEL DEVELOPMENT
POST – Graphical Post Processing – Animation – Icons – Isometric View – Zooming-Results of Analysis & Design – Query reports.

V. TEXTBOOKS:

1. Terence M. Shumaker, David A., Madsen, "*AutoCAD and its Applications: Advanced AutoCAD"*, Good heart-Wilcox, 12th edition, 2005.
2. Gupta, Ram S. "*Principles of Structural Design: Wood, Steel, and Concrete"*. CRC Press/Taylor & Francis Group, 2nd Edition, 2014.

VI. REFERENCE BOOKS:

1. Dr M.N. Sesha Prakash and Dr. G.S. Servesh, "*Computer Aided Design Laboratory*", Laxmi Publications, 1st Edition, 2016.
2. Omura, George, and Brian C. Benton. "*Mastering AutoCAD 2018 and AutoCAD LT 2018*". John Wiley & Sons, 2017.

VII. ELECTRONICS RESOURCES:

1. https://structuralbd.com/dwg-file-sample/.
2. https://books.google.co.in/books/about/AutoCAD_and_Its_Applications.html?id=BAaznio6H5oC&redir_esc=y.
3. https://dwgmodels.com/construction_details/.

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Lab Manual

COURSE CONTENT

ADVANCED CONCRETE LABORATORY								
I Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE12	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Concrete Technology Laboratory								

I. COURSE OVERVIEW:

Advanced concrete laboratory provides a comprehensive coverage of the theoretical and practical aspects of the subject and includes the latest developments in the field of concrete construction. It incorporates the latest Indian standard specifications and codes regulating concrete construction. The properties of concrete and it constituent materials and the role of various admixtures in modifying these properties to suit specific requirements, such as ready-mix concrete, reinforcement detailing, disaster-resistant construction, and concrete machinery have been treated exhaustively the and also special concrete in addition to the durability maintenance and quality control of concrete structure.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Mechanical behavior of concrete through stress–strain, tensile, flexural, and shear tests.
II. Correlations among cube, cylinder, tensile, and flexural strengths of concrete.
III. The assessment of concrete quality using Non-Destructive Testing and evaluate permeability and durability.
IV. The workability and strength characteristics of self-compacting concrete.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Construct the stress-strain curve of high strength concrete for the design of RC structures.

CO 2 Develop the correlation between cube strength and cylinder strength for understanding the different codal provisions other than IS.

CO 3 Determine the relation between compressive strength and split tensile strength for the analysis of concrete in tension.

CO 4 Identify the relation between the compressive strength and modulus of rupture of concrete for understanding the behavior of concrete in rupture.

CO 5 Test for the Non-Destructive testing of concrete members using rebound hammer and ultrasonic pulse velocity.

CO 6 Explain the behavior of beams under flexure, shear and torsion for design purpose.

IV. COURSE CONTENT:

Week-I: STRESS STRAIN CURVE FOR CONCRETE
Study of stress-strain curve of high strength concrete.

Week-II: CORRELATION BETWEEN CUBE STRENGTH AND CYLINDER STRENGTH
Correlation between cube strength and cylinder strength.

Week-III: DETERMINTION OF SPLIT TENSILE STRENGTH OF CONCRETE
Split tensile strength.

Week-IV: DETERMINTION OF MODULUS OF RUPTURE OF CONCRETE
Modulus of rupture.

Week-V: RELATION BETWEEN COMPRESSIVE STRENGTH AND SPLIT TENSILE STRENGTH
Correlation between compressive strength and cylinder strength.

Week-VI: RELATION BETWEEN COMPRESSIVE STRENGTH AND MODULUS OF RUPTURE
Effect of cyclic loading on steel.

Week-VII: NON – DESTRUCTIVE TEST (NDT)
Non-Destructive testing (rebound hammer) of existing concrete members.

Week-VIII: PERMEABILITY OF CONCRETE TEST
Permeability of concrete test.

Week-IX: SHEAR STRENGTH TEST
Behavior of Beams under Shear.

Week-X: TORSION STRENGTH TEST
Behavior of steel under Torsion.

Week-XI: WORKABILITY TEST ON SELF COMPACTING CONCRETE
Determine the workability of self-compacting concrete by using L-box, U-box, V-Funnel and J-ring.

Week-XII: QUALITY OF CONCRETE USING NDT
Determine the uniformity of concrete using Ultra sonic pulse velocity.

Week-XIII: STRENGTH OF SCC WITH DIFFERENT W/C RATIOS
Determine the strength of Self compacting concrete with different W/C ratios.

Week-XIV: DURABILITY OF CONCRETE
Determine the durability of concrete

V. TEXTBOOKS:

1. Shetty, M. S., "*Concrete Technology*", S. Chand and Co. Publishers, 3rd Edition, 2006.
2. Taylor, Walter Harold. "*Concrete Technology and Practice*, 4/E.", 1967.

VI. REFERENCE BOOKS:

1. Dr. S. Kandasamy, Dr.S. Syed Ibrahim, Dr.S. Pradeep Kumar, "*Advanced Concrete Technology*", Notion Press, 2020.
2. S.S. Bhavikatti, "*Concrete Technology*", Dream tech Press, 2019.

VII. ELECTRONICS RESOURCES:

1. http://kec.edu.np/wp-content/uploads/2017/06/Advanced-Concrete-Technology.pdf.
2. http://alphace.ac.in/downloads/notes/cv/10cv81.pdf.

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Lab manual

COURSE CONTENT

FINITE ELEMENT ANALYSIS								
II Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE13	Core	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Construction Materials, Concrete Materials								

I. COURSE OVERVIEW:

The Finite Element Method (FEM) is widely used in industry for analyzing and modelling structures and continua, whose physical behavior is described by ordinary and partial differential equations. The FEM is particularly useful for engineering problems that are too complicated to be solved by classical analytical methods. The main objective of this course is to introduce the mathematical concepts of the Finite Element Method for obtaining an approximate solution of ordinary and partial differential equations. In this course you will attend lectures on the fundamentals of the Finite Element Method. The learning process will be enhanced by completing assignments using mathematical software. You will also be introduced to a commercial Finite Element software package–ANSYS during lectures with computer laboratories providing opportunities to practice on, and to complete practical assignments, using ANSYS.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals of domain discretization, interpolation, application of boundary conditions, assembly of global matrices, and solution of the resulting algebraic systems.
II. The element stiffness matrix for 1-D, 2-D and 3-D problems.
III. Formulation of simple structural problems in to finite elements.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the concepts of matrix analysis of structures for understanding the FEM.

CO 2 Build and Analyse the FEA models for various engineering problems

CO 3 Analyze the one- and two-dimensional structures using beam and bar elements

CO 4 Identify the requirements and sources for analysis, design and evaluation

CO 5 Interpret the results obtained from FEA software, and arrive at the conclusions

CO 6 Use the standard finite element software to solve the structural engineering problems

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO FINITE ELEMENT METHODS (9)

Types of Problems , Types of Materials, Elastic / Inelastic situations, Types of forces: Body forces / Surface Traction / Point loads, Deformable bodies, Types of Deformations, Homogeneous, Non-homogeneous Problems, Equations of equilibrium for elastic 2-D / 3-D continua, Equilibrium equations for 2-D / 3-D boundary elements, Boundary conditions, Strain- displacement relation for 2-D / 3-D Stress-strain relation for 2-D / 3-D Plane stress, Plane strain problems.

Virtual Work Formulation: Application to problems of plane trusses with static indeterminacy not exceeding three.

MODULE-II: VARIATIONAL FORMULATION (10)

Approximate methods of Analysis- Weighted residual method - RayleighRitz Method -Strong form weak form - Variational principle - Stationarity Functional or Differential equation.

Finite element formulation for1-D problems: Minimum Potential Energy Approach, week form approach, introduction to natural coordinates -Finite element approximations in one-dimension Lagrangian Approximation- Hermitian approximations, FE formulation for Axial bar, Euler Bernoulli beam -Numerical Examples.

Finite element formulation for 2-D problems: FE Approximation in 2-Dimension, Pascal's triangle, Convergence criterion, Compatible and incompatible elements, FE Formulation for plane stress, plane strain and Axi-symmetrical problems, Shape functions for 2-Dimensional CST Element-4 noded quadrilateral element -Higher order triangular and rectangular elements- Consistent Nodal load vector -Numerical Examples

MODULE-III: ISO-PARAMETRIC ELEMENTS (9)

Quadrilateral elements: FE Formulation for linear and quadratic isoperimetric elements Construction of shape functions using natural coordinates, Strain-displacement matrices, Load matrices for body force and surface traction, Expressions for stiffness matrix, load matrices for 4- noded quadrilateral elements.

Gauss Quadrature of numerical integration, Problems with rectangular elements, kinematic indeterminacy not exceeding three- Determination of shape functions for 2nd order quadrilateral elements and for elements of with serendipity, Strain-displacement matrices, Load matrices for body force and surface traction.

MODULE-IV: FINITE ELEMENT FORMULATION FOR 3 -D ELEMENTS (9)

FE Formulation for Tetrahedral and Hexahedral elements: Volume coordinates, Strain-displacement matrix, stiffness matrix, load matrices due to body force and surface traction/ introduction to Hexahedron (brick) elements. Galerkin's Method of Weighted Residuals, Application to problems of mathematics / structural engineering, number of trial functions not exceeding two. Weak form of Trial Function - Application to problems of mathematics / structural engineering, number of elements limited to two - Strain-displacement relationship/stress-strain relationship / determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction/ Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only

MODULE-V: NUMERICAL EXAMPLES (9)

Simple 1-D model, 2-D model and a 3-D model/ analysis and post processing of the results using commercially available FEA software and available codes.

V. TEXTBOOKS:

1. Reddy, J. N. "*An Introduction to the Finite Element Method*". McGraw-Hill, 1993.
2. Cook, R. D. "*Concepts and Applications of Finite Element Analysis*". John Wiley & Sons, 1981.
3. Zienkiewicz, O. C., and R. L. Taylor. "*The Finite Element Method. Vol. 1"*. McGraw-Hill Company Limited, 1989.

VI. REFERENCE BOOKS:

1. Chandrupatla, T. R., and A. D. Belegundu. "*Introduction to Finite Elements in Engineering"*. Prentice Hall of India, 2001.
2. Seshu, P. "*Finite Element Analysis"*. Prentice Hall of India Pvt. Ltd., 2003.
3. Hutton, David V. "*Fundamentals of Finite Element Analysis"*. Tata McGraw-Hill Publishing Company Ltd., 2005.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/112104193
2. https://nptel.ac.in/courses/112106135

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

STRUCTURAL DYNAMICS								
II Semester: STE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE14	Core	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Analysis of structures								

I. COURSE OVERVIEW:

Structural Dynamics is of utmost importance for understanding the analysis and design consideration of structures subjected to dynamic loading. This course introduces the basic concepts of dynamic loading and the response of structures to such loads, and then uses these concepts to illustrate applications in practical structures. It begins with the derivation of the basic equations of motion for an ideal single degree-of-freedom structure using various approaches, and the solution of these equations for different types of loading. Further, the development of equations for multi-degree-of-freedom structures is considered, with multi-storied buildings as the example structures, and free and forced vibration response analysis of these multi-storied buildings shall be discussed.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The dynamics response of single and multi-degree freedom systems using fundamental theory and equations of motion.
II. The numerical solution of structural responses of different loading conditions for the design of structures.
III. The responses of structures subjected to earthquakes and blasts for the efficient and economic design of structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the concepts response of a system under vibrations on the structures for understanding the behavior of structures.
CO 2 Outline the concept of damped vibrations of single degree freedom systems for the analysis of structures subjected to dynamic loads.
CO 3 Develop the expressions for response of single degree freedom systems based on loading function for the response of structure used in design.
CO 4 Develop the equations of structural response to dynamic loads using Duhamel's integral and fourier analysis.
CO 5 Analyze the two-degree freedom systems subjected to free and forced vibrations for the design purpose.
CO 6 Analyze the multiple degree of freedom systems to know the natural frequencies, modes and mode shapes using orthogonality and normality principles and superposition method.

IV. COURSE CONTENT:

MODULE –I: THEORY OF VIBRATIONS (9)

Introduction, basic concepts of vibration, dynamic loading, comparison of static loading and dynamic loading, causes od dynamic effects, basic definitions types of vibration, response of the system, degrees of freedom, SHM, Consequences of vibration. Introduction to undamped vibrations, vibration analysis, free vibration of undamped SDOF system, derivation of equation of motion, solution of the equation of motion, equivalent stiffness of spring combinations, natural frequency, time period, influence of gravitational force.

MODULE -II: DAMPED VIBRATIONS OF SDOF SYSTEM (9)

Introduction types of damping, measurement of damping. Introduction to harmonic excitation, undamped harmonic excitation, damped harmonic excitation, characteristics curves, measurement of damping, vibration measuring instruments, vibration isolation.

MODULE -III: RESPONSE TO PERODIC AND IMPULSIVE LOADING (10)

Introduction to periodic loading, Fourier series and analysis and response, derive an expression for the response of an SDOF system for the given loading function.

Introduction to impulsive loading, differential equation method, Duhamel's integral.

MODULE -IV: TWO DEGREE OF FREEDOM SYSTEM (8)

Introduction, concept of shear building, free vibrations of undamped system, damped free vibration, forced vibrations of undamped system, forced vibrations of damped system.

MODULE -V: MULTIPLE DEGREE OF FREEDOM SYSTEM (9)

Introduction, Free vibration analysis, undamped system, natural frequencies and normal modes, orthogonality and normality principles, damped systems, decoupling of equations, superposition method, forced vibration.

V. TEXT BOOKS:

1. S. Kavita and S. R. Damodaraswamy, "*Basics of structural Dynamics and Aseismic Design*", PHI Learning Pvt. Ltd., 1st Edition, 2012.
2. Clough R. W. and Penzien J, "*Dynamics of Structures*", McGraw Hill, 1st Edition, 1993.
3. Chopra A. K, "*Structural Dynamics and Introduction to Earthquake Engineering*", Prentice Hall, 4th Edition, 2012.
4. Smith J. W, "*Vibration of Structures - Application in Civil Engineering Design*", Chapman and Hall, 1st Edition, 1988.

VI. REFERENCE BOOKS:

1. Humar J. L., "*Dynamics of Structures*", Prentice Hall, 2nd Edition, 2002.
2. Paz Mario, "*Structural Dynamics Theory and Computation*", CBS Publication, 5th Edition, 2002.
3. Hart and Wong, "*Dynamics of Structures*", John Wiley, 1st Edition, 1999.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105101006/

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

DESIGN OF ADVANCED CONCRETE STRUCTURES								
II Semester: STE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE15	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Design of RC Structural Elements								

I. COURSE OVERVIEW:

The course Design of Advanced Concrete Structures builds upon the fundamentals of reinforced and prestressed concrete design to prepare students for handling complex, real-world structural systems. Unlike basic reinforced concrete design, this course focuses on special structural elements and systems such as deep beams, corbels, grid floors, flat slabs, shear walls, silos, bunkers, water tanks, and prestressed members that are frequently encountered in high-rise buildings, bridges, silos, reservoirs, and industrial facilities.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The design of reinforced and prestressed concrete structural elements using advanced concepts.
II. Codal provisions (IS 456:2000, IS 1343:2012, SP 16) for advanced structural design applications.
III. The design of special structural elements by understanding their behavior under shear and bending moments.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the behavior of reinforced concrete under flexure and shear for designing beams, slabs and columns under various load condition.
CO 2 Explain the concepts of plastic hinge and plastic moment for understanding the redistribution of moments and moment rotation characteristics of reinforced concrete members.
CO 3 Analyse flat and ribbed slabs under given loading for designing and obtaining the reinforcement detailing in end and middle strips of the slab.
CO 4 Analyse the load distribution in deep beams for designing and fixing of reinforcement details in deep beams.
CO 5 Develop the concept of axial, uni-axial and bi-axial loading on compression members for designing the same to meet the safety and serviceability conditions.
CO 6 Analyse the soil properties for designing various types of footings for transferring the superimposed loads safely to the soil beneath.

IV. COURSE CONTENT:

MODULE –I: BASIC DESIGN CONCEPTS (9)
Behavior in flexure, design of singly reinforced rectangular sections, design of doubly reinforced rectangular sections, design of flanged beams, design of shear, design for torsion, Limit state of serviceability: Deflections of reinforced concrete beams and slabs, short term deflection and long-term deflection, estimation of crack width in RCC members, calculation of crack widths.

MODULE -II: LIMIT ANALYSIS OF R.C. STRUCTURES (9)
Rotation of a plastic hinge, redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, applications for fixed and continuous beam. Yield line analysis for slabs: Upper bound and lower bound theorems, yield line criterion, virtual work and equilibrium methods of analysis for square and circulars labs with simple and continuous end conditions.

MODULE -III: DESIGN OF RIBBED SLABS, FLAT SLABS (10)
Analysis of the slabs for moment and shears, ultimate moment of resistance, design for shear, deflection, arrangement of reinforcements. Flat slabs: Direct design method, distribution of moments in column strips and middle strip moment.
Shear transfer from slabs to columns, shear in flat slabs, check for one way and two-way shears, introduction to equivalent frame method. Limitations of direct design method, distribution of moments in column strips and middle strip.

MODULE -IV: DESIGN OF REINFORCED CONCRETE DEEP BEAMS & CORBELS (08)
Steps of designing deep beams, design by IS 456, checking for local failures, detailing of deep beams, design of curved beams, analysis of forces in a corbel, design of procedure of corbels, design of nibs.

MODULE -V: DESIGN OF CHIMNEY, BUNKER AND SILOS (09)
Design of chimneys: parts of chimney, design factors, stresses in RC shafts due to self-weight, wind load and temperature difference, reinforcement details, Design of bunkers and silos: Difference between bunker and silo, design of square or rectangular bunkers, design of circular bunkers, design of silos, Design concepts and IS code provisions.

V. TEXTBOOKS:

1. Pillai S. U. and Menon D, "*Reinforced Concrete Design*", Tata McGraw-Hill, 3rd edition, 1999.
2. S. Unnikrishna Pillai & Menon, "*Reinforced concrete design*", Tata McGraw Hill, 3rd edition, 2009
3. Park R. and Paulay T, "*Reinforced Concrete Structures*", John Wiley & Sons, 1995.

VI. REFERENCE BOOKS:

1. Varghese P. C, "*Advanced Reinforced Concrete Design*", Prentice Hall of India, New Delhi, 1995.
2. Hsu T. T. C. and Mo Y. L, "*Unified Theory of Concrete Structures*", John Wiley & Sons, 2010.
3. Salmon C. G., Johnson J. E. and Malhas F. A. "*Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design",* Pearson Education, 5th Edition, 2009.
4. Ramchandra, "*Design of Steel Structures*", Vol. II, Standard Book House, Delhi, 1999.

VII. ELECTRONICS RESOURCES:

1. https://lecturenotes.in/course/179/design-of-advanced-concrete-structures-dacs?utm_source=chatgpt.com
2. https://nptel.ac.in/downloads/105105104/?utm_source=chatgpt.com

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

DESIGN OF HIGH-RISE STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE16	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Reinforced Concrete Structures Design and Drawing, Steel Structures Design and Drawing								

I. COURSE OVERVIEW:

The high-rise building is generally defined as one that is taller than the maximum height. The foundations of high-rise buildings must sometimes support very heavy gravity loads, and they usually consist of concrete piers, piles, or caissons that are sunk into the ground. Skyscrapers are created using a steel skeleton structure. Giant girder grids are formed by riveting metal beams end to end to form vertical columns. At each floor, the vertical columns are connected to horizontal girder beams to help strengthen and reinforce the structure.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Analysis, design and detailing of Transmission/ TV tower, Mast and Trestles with different loading conditions.
II. The design principles and techniques such as P-Delta effect, soil structure interaction for efficient design of high rise structures.
III. The behavior of various structural systems under extreme loading conditions.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the configuration, bracing systems, and behavior of transmission/TV towers, and analyze their response to vertical, transverse, and longitudinal loads.
CO 2 Analyze and design reinforced concrete and steel chimneys, including suitable foundation systems for different soil conditions.
CO 3 Evaluate structural concepts, configurations, and systems for tall buildings considering architectural and functional requirements.
CO 4 Apply principles of gravity loads, wind loads, seismic effects, and load combinations (including live load reduction and impact loads) in the design of tall structures.
CO 5 Interpret IS code provisions and design considerations for firefighting and fire safety in tall buildings.
CO 6 Utilize structural analysis and design software tools for the modeling, analysis, and design of tall structures.

IV. COURSE CONTENT:

MODULE-I: DESIGN OF TRANSMISSION/ TV TOWER (9)

Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

MODULE-II: ANALYSIS AND DESIGN OF RC AND STEEL CHIMNEY (9)

Types of chimneys – Loads and stresses – IS code provisions – Analysis and design of RC and steel chimneys – Design of base plate, anchor bolts, and liners – Foundation design for different soil strata..

MODULE-III: TALL BUILDINGS (09)

Structural Concept, Configurations, various systems, factors affecting growth, height and structural form.

Gravity load, dead load, live load, live load reduction technique, impact load, Wind and Seismic loads, combination of load.

MODULE-IV: FIREFIGHTING PROVISION OF TALL BUILDINGS (08)

Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.

MODULE-V: APPLICATION (9)

Analysis and design of tall buildings under combined loading conditions with emphasis on structural behavior, stability, and performance evaluation through case studies.

V. TEXT BOOKS:

1. Varyani U. H, "*Structural Design of Multi-storeyed Buildings*", South Asian Publishers, New Delhi, 2nd Edition, 2002.
2. Taranath B. S, "*Structural Analysis and Design of Tall Building*", McGraw Hill, 1988.
3. Shah V. L. & Karve S. R., "*Illustrated Design of Reinforced Concrete Buildings (GF+3 storeyed)",* Structures Publications, Pune, 2013.

VI. REFERENCE BOOKS:

1. Smith Byran S. and CoullAlex, "*Tall Building Structures*", Wiley India. 1991.
2. Wolfgang Schueller, "*High Rise Building Structures*", Wiley., 1971

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105106113/13
2. http://www.byggmek.lth.se/fileadmin/byggnadsmekanik/publications/tvsm5000/web5213.pdf

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

DESIGN OF MASONRY STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE17	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Probability and Statistics								

I. COURSE OVERVIEW:

This course provides in-depth knowledge of masonry as a structural material and its applications in building design. Students will learn the behavior of masonry under compression, flexure, and shear, as well as the design principles of load-bearing and earthquake-resistant masonry buildings. Special emphasis is given to codal provisions, construction practices, and the performance of historical masonry structures such as arches, domes, and vaults.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Characteristics and properties of masonry units and mortars.
II. Strength and failure mechanisms of masonry under compression, flexure, and shear.
III. Codal provisions for the design of load-bearing masonry walls and buildings.
IV. Principles and practices for earthquake-resistant masonry construction, including arches, domes, and vaults.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the properties of masonry units and mortars and their role in masonry strength and durability.
CO 2 Analyze the behavior of masonry under compression, considering unit properties, slenderness, eccentricity, and workmanship.
CO 3 Examine flexural bond, shear bond, and orthotropic strength properties of masonry using test methods.
CO 4 Design load-bearing masonry walls and buildings up to multiple storey's as per BIS codal provisions.
CO 5 Apply principles of earthquake-resistant design to masonry buildings, arches, domes, and vaults.
CO 6 Assess the performance of masonry structures under vertical, lateral, and seismic loads for safe and economical construction.

IV. COURSE CONTENT:

MODULE –I: INTRODUCTION (9)
History of masonry Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars.

MODULE -II: STRENGTH OF MASONRY IN COMPRESSION (9)
Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, Failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength.

MODULE -III: FLEXURAL AND SHEAR BOND, FLEXURAL STRENGTH AND SHEAR STRENGTH (9)
Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength,

Orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength.

MODULE -IV: DESIGN OF LOAD BEARING MASONRY BUILDINGS (10)
Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storey using BIS codal provisions.

MODULE -V: EARTHQUAKE RESISTANT MASONRY BUILDINGS (8)
Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions. Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure.

V. TEXTBOOKS:

1. Hendry, A.W., "*Structural Masonry*", Palgrave Macmillan, 2nd Edition, 1988.
2. Dayaratnam, P., "*Brick and Reinforced Brick Structures*", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.
3. Jagadish, K.S., Venkatarama Reddy, B.V., & Nanjunda Rao, K.S., "*Alternative Building Materials and Technologies*", New Age International Publishers, New Delhi, 2007.

VI. REFERENCE BOOKS:

1. Sinha, B. P., and A. W. Hendry. "*Design of Masonry Structures",* Granada Publishing Ltd., London, 2nd Edition, 1979.
2. Liauw, T. C., and K. H. Kwan. "*Design of Reinforced and Prestressed Masonry".* Longman Scientific & Technical, UK, 1984.
3. Morton, R. "*Structural Design of Masonry Buildings*". BRE Press, UK, 2005
4. Bureau of Indian Standards. IS 1905: Code of Practice for Structural Use of Unreinforced Masonry. New Delhi: Bureau of Indian Standards, 1987.
5. Bureau of Indian Standards. IS 4326: Earthquake Resistant Design and Construction of Buildings – Code of Practice. New Delhi: Bureau of Indian Standards, 2013.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105106197
2. https://nptel.ac.in/courses/105102088

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

BRIDGE ENGINEERING								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE18	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

This course focuses on the analysis and design of reinforced and prestressed concrete bridges, covering types of bridges, loading conditions, and general design requirements. It introduces design methods for solid slab, girder, and continuous bridges, fundamentals of prestressing, and design of prestressed components. Advanced analysis techniques such as grillage analogy, finite strip, and FEM are included, along with the design of substructures like piers and abutments. The course equips students with practical knowledge and computational skills for designing durable concrete bridges as per codes and standards.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.
II. The sizing of bridge elements, i.e. Develop a clear understanding of conceptual design.
III. The load flow mechanism and identify loads on bridges.
IV. The design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the classification of bridges, types of loads, and general design requirements considering structural, functional, and environmental effects.
CO 2 Apply methods of design for solid slab and girder bridges, and analyze continuous bridges using Courbon's theory and influence line methods.
CO 3 Demonstrate the fundamentals of prestressing, different systems of prestressing, and calculate losses in prestress for bridge members.
CO 4 Design prestressed concrete bridge components under various limit states, considering cracking, shear, diagonal tension, composite action, and reinforcement requirements.
CO 5 Analyze bridge decks using advanced methods such as harmonic analysis, grillage analogy, finite strip method, and FEM.
CO 6 Design sub-structural elements of bridges including bed blocks, piers, and abutments under different loading and site conditions.

IV. COURSE CONTENT:

MODULE-I: CONCRETE BRIDGES (09)
Introduction, types of bridges, economic span length, types of loading, dead load, live load, impact effect, centrifugal force, wind loads, lateral loads, longitudinal forces, seismic loads, frictional resistance of expansion bearings-secondary stresses, temperature effect erection forces and effects, width of roadway and footway, general design requirements.

MODULE-II: SOLID SLAB, GIRDER BRIDGES & CONTINUOUS BRIDGES (09)
Introduction, method of design. Girder bridges, introduction, method of design, courbon's theory. Continuous bridges, introduction span lengths, analysis of continuous bridges, decking of girders with constant moment of inertia, continuous bridges with variable moment of inertia, method of analysis, girders with parabolic soffit, method of plotting influence lines, girders with straight haunches, design steps for continuous bridges.

MODULE-III: PRE-STRESSED CONCRETE BRIDGES: FUNDAMENTALS (09)
Basic principles, method of pre-stressing-pre tensioning and post-tensioning, comparison, freyssinet method, magnel, blanet system-lee-mc call system basic assumptions.

Losses in pre stress-equation based on initial and final stress conditions cable zone, design of selections.

MODULE-IV: PRE-STRESSED CONCRETE BRIDGES: DESIGN (9)
Condition of first crack, ultimate load design, shear, vertical pre stressing, diagonal tension in i- section, end block, magnel's method, empirical method general design requirements, mild steel reinforcement in pre stressed concrete member, concrete cover and spacing of pre-stressing steel, slender beams, composite section, propped, design of propped composite section, un propped composite section, two stage pre stressing, shrinking stresses, general design requirements for road bridges

MODULE-V: ANALYSIS OF BRIDGE DECKS AND SUB-STRUCTURES (8)
Harmonic analysis and folded plate theory, grillage analogy, finite strip method and fem. Substructure, beds block, piers, pier dimensions, design loads for piers, abutments, design loads for abutments.

V. TEXTBOOKS:

1. E.C. Hambly, "*Bridge deck behavior*", E & FN SPON Publications, New York, 1991.
2. V.K. Raina, "*Concrete bridge practice, analysis, design and economics*", Tata McGraw Hills Publishing Company Limited, New Delhi, India, 1991.
3. M. G. Aswani, V.N.Vazirani, M.M. Ratwani, "*Design of Concrete Bridges*", Khanna Publishers, New Delhi, 2013.

VI. REFERENCE BOOKS:

1. Ryall, M.J., Hewson, N., Parke, G.A.R. and Harding, J.E, "*The manual of Bridge Engineering*" eds., Thomas Telford. 2000.
2. R. Rajagopalan, "*Bridge Super Structure*", Tata McGraw Hills Publishing Company Limited, 2008.
3. Ponnuswamy, "*Bridge engineering*", Tata McGraw - Hills Publishing Company Limited, 2008.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/syllabus/syllabus_pdf/105102011.pdf
2. http://www.highestbridges.com/wiki/index.php?title=10_Great_Bridge_Books_and_Web_Sites
3. http://www.highestbridges.com/pdf/Waddell%20-%20Bridge%20Engineering.pdf
4. https://accessengineeringlibrary.com/browse/bridge-engineering-second-edition
5. https://drive.google.com/file/d/0BwoIGOzEq0cMMy02VVFmR2Zad3M/edit

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank

3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ADVANCED STEEL DESIGN								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE19	Elective	3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Steel Structures Design and Drawing								

I. COURSE OVERVIEW:

This course is designed for postgraduate students in the Structural Engineering program who seek to advance their knowledge in the analysis and design of steel structures. It introduces the mechanical properties and specifications of structural steels, along with the design considerations governing their use. The course emphasizes the behavior and design of key structural components, including tension members, compression members, beams (laterally restrained and unrestrained), beam-columns, and steel connections. Both bolted and welded connections are covered, with attention to their design procedures, performance, and failure modes. Students will develop a comprehensive understanding of the iterative nature of structural design, integrating material behavior, analysis principles, and codal provisions. By the end of the course, students are expected to demonstrate competence in designing simple and complex steel structural members and connections, as well as in recognizing potential failure mechanisms.

II. COURSE OBJECTIVES:

The student will be able to:

I. Design and evaluate steel connections such as riveted, bolted, pinned, and welded joints by applying codal provisions, considering load transfer, efficiency, and possible modes of failure.
II. Analyze and design structural steel elements including gantry girders and roof trusses, along with secondary components such as purlins, knee-braced systems, and bracings, under various loading conditions.
III. Develop safe and economical designs for industrial steel structures and truss girder bridges by applying codal methodologies to ensure strength, stability, and serviceability.
IV. Analyze and design steel bunkers and silos for safe storage applications, considering relevant loading conditions, codal provisions, and structural integrity.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Analyze the load transfer mechanisms in riveted and bolted connections, and design joints considering strength, efficiency, and possible modes of failure.
CO 2 Design welded connections including groove welds, fillet welds, and intermittent welds, and evaluate their performance against different modes of failure.
CO 3 Analyze the loads acting on gantry girders due to electrically operated cranes, determine maximum moments and shears, and design gantry girders using codal provisions.
CO 4 Analyze dead loads, live loads, and wind loads on industrial buildings, and design structural components such as roof trusses, purlins, knee-braced trusses, stanchions, and bracing systems to ensure stability and serviceability
CO 5 Apply codal provisions and design methodologies to analyze and design steel truss girder bridges, satisfying strength, stability, and serviceability requirements for road bridges.
CO 6 Analyze the behavior of steel bunkers and silos using Janssen's and Airy's theories, and design hopper bottoms and storage bins to ensure safe storage and structural integrity.

IV. COURSE CONTENT:

MODULE-I: SIMPLE CONNECTIONS–RIVETED, BOLTED PINNED AND WELDED CONNECTIONS (9)

Riveted connection, bolted connections, load transfer mechanism, failure of bolted joints, specifications for bolted joints, bearing, type connections, tensile strength of plate, strength and efficiency of the joint, combined shear and tension, slip, critical connections, praying action, combined shear and tension for slip, Critical connections. Design of groove welds, design of fillet welds, design of intermittent fillet welds, failure of welds.

MODULE- II: DESIGN OF GANTRY GIRDER (9)

Introduction – Loads Acting on The Gantry Girder – Permissible Stresses - Types of Gantry Girders and Crane Sails – Crane Data – Maximum Moments and Shears – Design Procedure (Restricted To Electrically Operated Cranes)

MODULE-III: ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS (9)

Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; design of angular roof truss, tubular truss, truss for a railway platform.

Design of purlins for roofs, design of built-up purlins, design of knee braced trusses and stanchions. Design of bracings.

MODULE-IV: DESIGN OF STEEL TRUSS GIRDER BRIDGES (10)

Condition of first crack, ultimate load design, shear, vertical prestressing, diagonal tension in i- section, end block, magnel's method, empirical method general design requirements, mild steel reinforcement in prestressed concrete member, concrete cover and spacing of pre-stressing steel, slender beams, composite section, propped, design of propped composite section, un propped composite section, two stage prestressing, shrinking stresses, general design requirements for road bridges

MODULE-V: DESIGN OF STEEL BUNKERS AND SILOS (08)

Introduction, Jansen's theory, airy's theory, design of parameters, design criteria, analysis of bins, hopper bottom and design of bins.

V. TEXT BOOKS:

1. Dayaratnam, P. "*Design of Steel Structures"*. S. Chand, 2012.
2. Ramachandra, Dr., and Vivendra. "*Design of Steel Structures. Vol. II"*, Gehlot Scientific Publishers, Journals Department, 2012.
3. Duggal, S. K. "*Limit State Design of Steel Structures".* McGraw Hill Education Pvt. Ltd., New Delhi, 1994.

VI. REFERENCE BOOKS:

1. Gaylord, E. H., and C. N. Gaylord. "*Design of Steel Structures"*. Tata McGraw-Hill Education, 2012.
2. Bureau of Indian Standards. IS 800: General Construction in Steel – Code of Practice. New Delhi: Bureau of Indian Standards, 2007.
3. Kuzmanovic, B. O., and N. Willems. *"Steel Design for Structural Engineers".* Prentice Hall, 1997.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105106113/
2. https://www.iare.ac.in/sites/default/files/lecture_notes/lec%20notes%20ASD.pdf

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II

6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

DESIGN CONCEPTS OF SUBSTRUCTURES								
II Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE20	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite:								

I. COURSE OVERVIEW:

This course provides advanced knowledge on the design and analysis of substructures in geotechnical and structural engineering. Topics include soil-structure interaction, advanced bearing capacity theories, deep foundations, retaining systems, and ground improvement. Emphasis is on design methodologies, codal provisions, and case studies.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Advanced design concepts and analytical approaches for shallow and deep foundations.
II. Principles of soil–structure interaction and their application in foundation behavior.
III. Modern analysis and design techniques for retaining walls, braced excavations, and foundations in challenging soil conditions.
IV. Ground improvement methods and case studies highlighting practical solutions in geotechnical engineering.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Analyze soil-structure interaction using advanced theoretical models.
CO 2 Design shallow foundations, rafts, and mats under various loading conditions.
CO 3 Evaluate pile foundation behavior, capacity, and group action using analytical and codal approaches.
CO 4 Design well foundations, retaining walls, and braced excavations considering stability and safety.
CO 5 Recommend solutions for foundations in expansive, collapsible, and dynamic soil conditions.
CO 6 Apply ground improvement techniques to enhance substructure performance.

IV. COURSE CONTENT:

MODULE –I: SOIL–STRUCTURE INTERACTION (9)

Fundamentals of soil–structure interaction and its importance in foundation design. Analytical models such as Winkler's hypothesis and elastic continuum approach. Settlement analysis for rafts and piled raft foundations considering differential settlement.

MODULE -II: ADVANCED SHALLOW FOUNDATION DESIGN (9)

Classical and modern bearing capacity theories with correction factors. Analysis of shallow foundations subjected to eccentric, inclined, and dynamic loads. Design and performance evaluation of raft, mat, and compensated foundations with case studies.

MODULE -III: DEEP FOUNDATIONS (9)

Design of single piles and pile groups using static and dynamic approaches. Laterally loaded piles, uplift resistance, and negative skin friction concepts.

Codal provisions for pile design, load tests, and applications of well foundations.

MODULE -IV: RETAINING AND BRACED STRUCTURES (8)

Lateral earth pressure theories under static and seismic conditions. Design of rigid and flexible retaining walls with stability checks. Design principles of sheet piles, cofferdams, and braced excavations in urban construction.

MODULE -V: SPECIAL TOPICS AND GROUND IMPROVEMENT (10)

Design considerations for problematic soils such as expansive, collapsible, and marine clays. Introduction to machine foundations and dynamic soil–structure interaction. Ground improvement techniques – preloading, grouting, vibro-compaction, stone columns, and geosynthetics in foundation systems.

V. TEXT BOOKS:

1. Chen, W. F., and L. Duan, editors. "*Substructure Design"*. CRC Press, Taylor & Francis Group, 2014.
2. Jones, P. "*The Bones of the Book: Schematic Structure and Meaning Made from Books*". Doctoral dissertation, University of the Arts London, 2017.
3. Restall, Greg. "*An Introduction to Substructural Logics".* Routledge, 2002.

VI. REFERENCE BOOKS:

1. Arya, Chanakya. "*Design of structural elements: concrete, steelwork, masonry and timber designs to eurocodes*". CRC Press, 2022.
2. Allen, Matthew S., Daniel Rixen, "*Substructuring in engineering dynamics".* Cham, Switzerland: Springer International Publishing, 2020.
3. Reis, António J., and José J. Oliveira Pedro. "*Bridge design: concepts and analysis"*. John Wiley & Sons, 2019.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105105105
2. https://nptel.ac.in/courses/105105162

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

DESIGN OF INDUSTRIAL STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE21	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite:								

I. COURSE OVERVIEW:

The Design of Industrial Structures course focuses on the principles, analysis, and design of structures used in industrial applications, including factories, warehouses, power plants, and storage facilities. It covers the behavior of structural systems under various loads, material selection, and structural elements such as steel frames, trusses, and reinforced concrete members. The course emphasizes practical design considerations, including serviceability, stability, safety, and adherence to relevant codes and standards. By integrating theory with real-world industrial requirements, students gain the ability to design efficient, durable, and economical industrial structures.

II. COURSE OBJECTIVES:

The student will try to learn:

I. Develop an understanding of industrial structural systems.
II. Design principles, load analysis, and structural behavior of lightweight industrial structures.
III. Analyze structural stability, permissible stresses, and serviceability requirements for industrial structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Analyze and design steel gantry girders and portal frames for permissible stresses, moments and shears.
CO 2 Design gable structures and lightweight steel structures for structural stability using code provisions in industrial applications.
CO 3 Apply Jansen's, Airy's theories and IS codal provisions for designing steel bunkers, silos, and stiffeners.
CO 4 Design various types of steel water tanks, staging, base plates, stays, joints, and foundations for ensuring structural safety and durability.
CO 5 Design reinforced concrete (RC) Intze tanks for shear forces, moments, hoop tension, domes in compliance with IS codes.
CO 6 Design RC bunkers and silos, hopper bottoms, load considerations, and standard code practices for industrial storage structures.

IV. COURSE CONTENT:

MODULE-I: Steel Gantry Girders (09)
Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.
Portal Frames: Design of portal frame with hinge base, design of portal frame with fixed base, Gable Structures, Lightweight Structures.

MODULE-II: Steel Bunkers and Silos (09)
Design of square bunker, Jansen's and Airy's theories – IS Codal provisions, Design of side plates, Stiffeners, Hooper, Longitudinal beams, Design of cylindrical silo, Side
Plates, Ring girder, stiffeners.

MODULE-III: Chimneys and Intz Tanks (9)
Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

RC Intz Tanks: IS method of calculating shear forces and moments, Hoop tension, Design of intze tank, Dome, Ring girders, Conical dome, Staging, Bracings, Raft foundation.

MODULE-IV: Water Tanks (10)
Design of rectangular riveted steel water tank, Tee covers, Plates, Stays, Longitudinal and transverse beams, Design of staging, Base plates, Foundation and anchor bolts, Design of pressed steel water tank, Design of stays, Joints, Design of hemispherical bottom water tank, side plates, Bottom plates, joints, Ring girder, Design of staging and foundation.

MODULE-V: RC Bunkers and Silos (8)
Design of square bunker, Side Walls, Hopper bottom, Top and bottom edge beams, Design of cylindrical silo, Wall portion, Design of conical hopper, Ring beam at junction.

V. TEXTBOOKS:

1. Kanthimathinathan, S. "*Limit State Design of Steel Structures: As per IS 800:2007"*. Wiley, 2019.
2. Duggal, S. K. "*Limit State Design of Steel Structures*". 3rd Edition, McGraw Hill, 2019.
3. Park, R., and T. Paulay. "*Reinforced Cement Concrete Structures"*. MISL–Wiley Series, Wiley India Pvt. Ltd., 2009.

VI. REFERENCE BOOKS:

1. Varghese, "*Advanced Reinforced Concrete Design*", PHI pub., 2005, 2nd Edition
2. S.S. Bhavikatti, "*Advanced R.C.C Design*" (R C C Vol. 2), New Age International Pub. 3rd Edition, 2016,.

VII. ELECTRONICS RESOURCES:

1. https://www.youtube.com/watch?v=LrDdQvXnv-0
2. https://www.youtube.com/watch?v=qJV5zdx7NJs

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

MAINTENANCE AND REHABILITATION OF STRUCTURES								
II Semester: STE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE22	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Concrete Technology, Reinforced Concrete Design, Steel Design								

I. COURSE OVERVIEW:

Maintenance and Rehabilitation of Structures focus on extending the service life of civil engineering structures through systematic inspection, repair, strengthening, and preventive measures. This course provides an overview of structural deterioration mechanisms, condition assessment methods, and modern rehabilitation techniques in line with national and international standards. It emphasizes durability, safety, and sustainability by integrating advanced repair materials, non-destructive testing (NDT) technologies, and retrofitting strategies. Topics include causes of structural damage, evaluation and monitoring tools, repair and strengthening methods, rehabilitation of concrete, steel, and masonry structures, use of composites and polymers, seismic retrofitting, and case studies of restoration projects to ensure structural resilience and long-term performance.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Fundamentals of structural deterioration, distress mechanisms, and durability concerns affecting the service life of civil engineering structures.
II. Structural health assessment using non-destructive testing (NDT), condition evaluation, and monitoring techniques for identifying damage and performance issues.
III. Advanced repair, strengthening, and retrofitting techniques using modern materials and sustainable technologies to enhance structural performance and resilience.
IV. Case studies on maintenance, rehabilitation, and seismic retrofitting to understand effective practices, challenges, and strategies for extending structural life cycles.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the concepts of repair, retrofitting, strengthening, and rehabilitation by analyzing deterioration mechanisms and preventive measures for improving the durability of concrete structures.
CO 2 Evaluate corrosion mechanisms in steel reinforcement and assess structural damages due to fire, climate, and material deficiencies by applying destructive, non-destructive, and semi-destructive testing systems.
CO 3 Apply modern repair and strengthening techniques such as grouting, shotcreting, jacketing, and fiber wrapping for effective rehabilitation of masonry and concrete structures.
CO 4 Evaluate corrosion protection methods and crack repair techniques for improving durability and long-term performance of concrete and masonry structures.
CO 5 Analyze maintenance and retrofitting techniques such as jacketing, externally bonded reinforcement, and seismic rehabilitation strategies for enhancing safety and service life.
CO 6 Utilize advanced materials such as fiber-reinforced polymers, epoxy resins, special concretes, and monitoring tools for effective repair, retrofitting, and health assessment of structures.

IV. COURSE CONTENT:

MODULE –I: MAINTENANCE AND REPAIR STRATEGIES (9)
Definition of Repair, Retrofitting, Strengthening and rehabilitation, Deterioration of Structures – Distress in Structures – Causes and Prevention, Mechanism of Damage – Types of Damage, Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

MODULE -II: CORROSION OF STEEL REINFORCEMENT (9)
Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation, Damage Assessment -,Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems -Influence on Serviceability and Durability- Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

MODULE -III: REPAIRS TO MASONRY AND CONCRETE STRUCTURES (9)
Methods of crack repair in masonry and concrete structures, routing and sealing of cracks, removal and surface preparation in masonry and concrete structures, reinforcement repair, anchorage, placement methods; Shot-creting and guniting, Grouting- Portland cement grouting, chemical grouting, Dry packing, polymer impregnation.

Strengthening of structures flexural strengthening, Shear Strengthening, strengthening of columns- jacketing of Columns, strengthening by interior and external reinforcing, external Pre- stressing, Fiber wrapping, Corrosion Protection: surface treatment, joint sealants, cathodic protection.

MODULE -IV: MAINTENANCE AND RETROFITTING TECHNIQUES (9)
Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding (ERB) technique, near surface mounted (NSM) technique, External post- tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building, Inspection and Testing – Symptoms and Diagnosis of Distress - Damage assessment– NDT.

MODULE -V: MATERIALS FOR REPAIR AND RETROFITTING (9)
Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning- Health Monitoring of Structures – Use of Sensors – Building Instrumentation.

V. TEXTBOOKS:

1. Den Campbell, Allen and Harold Roper, "*Concrete Structures Materials, Maintenance and Repair*", Longman Scientific and Technical, UK, 1991.
2. Allen R.T and Edwards S.C, "*Repair of Concrete Structures*", Blakie and Sons, UK, 1987.
3. Philip H. Perkins, "*Repair, Protection and Waterproofing of Concrete Structures*", Elsevier Applied Science Publisher, London, New York, 1986.
4. P.C. Guha "*Maintenance and Repairs of Buildings* ", New Central Book Agency, Kolkata 2006.

VI. REFERENCE BOOKS:

1. Poonam I. Modi, Chirag N. Patel, "*Repair and Rehabilitation of Concrete Structures*," PHI Learning, 2016.
2. A.R. Santakumar, "*Concrete Technology*," Oxford University Press, 2018.
3. Bungley, Surrey "*Non-destructive evaluation of concrete structures*," University Press, 2012.
4. B.L. Gupta and Amit Gupta, "*Maintenance and Repair of Civil Structures*," Standard Publications, 2008

VII. ELECTRONICS RESOURCES:

1. https://www.vidyarthiplus.com/vp/thread-24896.html
2. https://cpwd.gov.in/Units/handbook.pdf

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

STRUCTURAL DESIGN LABORATORY								
II Semester: STE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE23	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Computer Aided Engineering Drawing								

I. COURSE OVERVIEW:

Structural Design Laboratory will summarize the key engineering, operational, safety, and sustainability considerations for the design of RC framed buildings. Introduces the design and behavior of large-scale structures and structural materials. This course emphasizes the development of structural form and the principles of structural design. This Laboratory used to solve structural problems by building and testing simple mathematical models. STAAD.Pro is one of the most widely used structural analysis and design software products worldwide. It can be used for analysis and design of all types of structural projects from buildings, bridges to towers, tunnels, metro stations, water/wastewater treatment plants and more.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basic elements with different loading type and supports with the aid of STAAD Pro software.
II. The Analysis and design of 2D Frame and multi-storey buildings with different load sets.
III. The Modeling and analysis of steel structures like beams and columns.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the basic commands of STADD Pro software for analysis and design of structural elements.

CO 2 Analyse the trusses subjected to various loading conditions in accordance with Indian Standard specifications.

CO 3 Analyse the rigid jointed frames subjected to different loading conditions using Indian standard specifications.

CO 4 Design of steel 2D and 3D trusses for industrial and bridge structures.

CO 5 Design of reinforced concrete rigid frames for multistoried structures.

CO 6 Make use of latest tools for analysis and design of sub-structures.

IV. COURSE CONTENT:

Week- I: INTRODUCTION TO STAAD SOFTWARE
Introduction to STAAD and its commands.

Week- II: STRUCTURAL SYSTEMS
General Description-Type of structure, Unit systems, structure geometry and Co-ordinate systems.

Week- III: COMMAND INPUTS
STAAD Pro –Commands- Using Edit Input-Command Formats-Text Input.

Week- IV: DEVELOPING GEOMETRY AND DIMENSIONING
Pre- Graphical Input Generation-Library- Geometry Generation – Dimensioning in STAAD Pro.

Week- V: 3D MODEL DEVELOPMENT
Post – Graphical Post Processing – Animation – Icons – Isometric View – Zooming-Results of Analysis & Design – Query reports in STAAD Pro.

Week- VI: ASSIGNING DIFFERENT LOAD PARAMETERS
LOAD – Member Load, Element Load, Joint Load, Floor Load, Self-weight Command, Load case no, Load Combination.

Week- VII: ANALYIS CONTINUOUS BEAM
Analysis of continuous Beams using STAAD Pro.

Week- VIII: ANALYIS OF TRUSS
Analysis of 2D Truss using STAAD Pro.

Week- IX: ANALYIS OF RIGID FRAMES
Analysis of 2D and 3D rigid frames using STAAD Pro.

Week- X: DESIGN OF RC BEAMS AND COLUMNS
Design of RC framed structures (Beams, columns) using STAAD Pro.

Week- XI: DESIGN OF SLABS
Design of RC slabs using STAAD Pro.

Week- XII: DESIGN OF FOOTINGS
Design of RC footing STAAD Pro.

Week- XIII: DESIGN OF CIRCULAR WATER TANKS
Design of circular water tanks using STAAD Pro.

Week- XIV: ANALYSIS AND DESIGN OF STEEL STRUCTURES
Analysis and Design of steel structures (Beams, columns).

V. TEXTBOOKS:

1. T.S.Sarma, "*Staad.Pro v8i for beginners*" Notion press, 2014.
2. Siva kumar Naganathan, "*Learn Yourself Staad Pro V8i*", Lap Lambert Academic Publishing GmbH KG, 2012.

VI. REFERENCE BOOKS:

1. Subramanian N, "*Design of Steel Structures*", Oxford Publication, 4th edition, 2008.

VII. ELECTRONICS RESOURCES:
1. https://onlinecourses.nptel.ac.in/noc17_ce21/preview.
2. https://civildigital.com/staad-pro-v8i-video-tutorials/

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Lab Manual

COURSE CONTENT

NUMERICAL ANALYSIS LABORATORY								
II Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE24	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Nil								

I. COURSE OVERVIEW:

This course introduces numerical techniques for solving linear and non-linear equations, curve fitting, integration, and ordinary differential equations (ODEs). Students will learn algorithms such as Bisection, Newton–Raphson, Secant, Gauss Elimination, Gauss–Seidel, Gauss–Jordan, Trapezoidal, Simpson's, Euler's, Runge–Kutta, Brent's, and Muller's methods. Emphasis is placed on computational implementation, enabling students to develop problem-solving skills using different programming languages.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Determination of roots of non-linear equations and solution of systems of linear equations using numerical methods.
II. Curve fitting and numerical integration using the method of least squares, Trapezoidal and Simpson's rules.
III. Numerical solution of ordinary differential equations using Euler's and Runge–Kutta methods.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Analyze the roots of non-linear equations using Bisection and Newton's methods to demonstrate accuracy in solving mathematical problems.
CO 2 Apply the method of least squares for curve fitting to validate data approximation and error minimization.
CO 3 Solve systems of linear equations using Gauss Elimination, Gauss–Seidel, and Gauss–Jordan methods to provide evidence of computational efficiency and correctness.
CO 4 Implement Trapezoidal and Simpson's rules for numerical integration to verify results against analytical solutions.
CO 5 Explain the application of Euler's method for solving ordinary differential equations to illustrate stepwise numerical approximation.
CO 6 Evaluate ordinary differential equations using Runge–Kutta methods to demonstrate improved accuracy in numerical solutions.

IV. COURSE CONTENT:

Week-I: Bisection Method
Apply the Bisection method to determine the roots of non-linear equations and prepare a report demonstrating convergence.

Week - II: Newton's Method
Implement Newton's method to find roots of non-linear equations and compare results with Bisection method outcomes.

Week-III: Curve Fitting
Perform curve fitting using the least squares approximation and validate results through error analysis.

Week-IV: Gauss Elimination Method
Solve systems of linear equations using the Gauss Elimination method and verify accuracy with sample problems.

Week-V: Gauss–Seidel Iteration Method
Apply the Gauss–Seidel iterative method to solve linear systems and evaluate rate of convergence.

Week-VI: Gauss–Jordan Method
Use the Gauss–Jordan method to solve linear equations and record computational steps for evidence of correctness.

Week-VII: Trapezoidal Rule
Implement the Trapezoidal rule for numerical integration and compare approximate results with exact integrals.

Week VIII: Simpson's Rule
Apply Simpson's rule for numerical integration and demonstrate improved accuracy over the Trapezoidal rule.

Week IX: Euler's Method
Use Euler's method to solve ordinary differential equations and interpret the numerical approximation graphically.

Week X: Runge–Kutta Method
Implement the Runge–Kutta method for solving ODEs and analyze its accuracy against Euler's method.

Week XI: Newton–Raphson Method
Solve non-linear equations using Newton–Raphson method and demonstrate convergence properties.

Week XII: Secant Method
Apply the Secant method for root finding and compare results with Newton–Raphson method.

Week XIII: Brent's Method
Implement Brent's method for solving equations and validate its robustness in convergence.

Week XIV: Muller's Method
Use Muller's method to solve equations and analyze its efficiency for complex roots.

V. TEXTBOOKS:

1. Steven Chapra and Raymond Canale, "*Numerical Methods for Engineers"*, McGraw Hill, 7th Edition, 2015.

VI. REFERENCE BOOKS:

1. K. Sankara Rao, "*Numerical Methods for Scientists and Engineers"*, PHI Learning, 4th Edition, 2018.

VII. ELECTRONICS RESOURCES:

1. https://www.iitg.ac.in/physics/fac/charu/courses/ph508/lab5.pdf?utm_source=chatgpt.com

2. https://www.youtube.com/watch?v=HtXDcu6l2_w&t=1s

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Laboratory manual

COURSE CONTENT

DESIGN OF PRESTRESSED CONCRETE STRUCTURES								
III Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE26	Elective	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Design of RC Structural Elements								

I. COURSE OVERVIEW:

A prestressed concrete structure is different from a conventional reinforced concrete structure due to the application of an initial load on the structure prior to its use. In prestressed concrete high strength concrete and high strength steel are combined such that the full section is effective in resisting tension and compression. This is an active combination of the two materials. This subject provides students an understanding and ability to analyse and design prestressed concrete structural elements. The primary topics includes the concept and principles of prestressing, methods of prestressing concrete, stress limits, losses of prestress, selection of section, serviceability and strength requirements. Students will also be able to complete analysis and design procedure of simply supported prestressed concrete non-composite and composite beams.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts of prestressed concrete structures and the behaviour of these structures subjected to loads for the design purpose.
II. Design procedure for structural elements necessary for creating efficient and economic prestressed concrete structures.
III. Design and drawing of multi storeyed industrial and residential structures including bridges for creating high performance and durable structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the concept of methods of pre and post tensioning and the systems of prestressing for the designing of prestressed concrete structural elements.
CO 2 Estimate the losses in the prestress and post tensioned members for the efficient design of prestressed concrete structures.
CO 3 Analyze prestressed concrete structural elements subjected to flexure for the design purpose.
CO 4 Design prestressed concrete structural elements subjected to shear using Indian standard code method.
CO 5 Apply the concepts of transfer of prestress in pre and post tensioned members through bond for effective utilization of prestressing force.
CO 6 Design the composite prestressed concrete structural elements subjected to flexure and shear for designing multi storied structures.

IV. COURSE CONTENT:

MODULE –I: INTRODUCTION TO PCS (9)
Historic development- General principles of pre-stressing pre-tensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of pre-stressing Materials- high strength concrete and high tensile steel their characteristics. Methods and Systems of prestressing: Pre-tensioning and Post-tensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system.

MODULE -II: LOSSES OF PRE-STRESS (9)
Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional losses.

MODULE -III: FLEXURE AND SHEAR (9)
Analysis of sections for flexure, beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams, Elastic design of PSC beams of rectangular and I section Kern line, Cable profile and cable layout.

Shear: General Considerations, Principal tension and compression, improving shear resistance of concrete by horizontal and vertical pre-stressing and by using inclined or parabolic cables, Analysis of rectangular and I beam for shear, Design of shear reinforcements- Bureau of Indian Standards (BIS) Code provisions.

MODULE -IV: TRANSFER OF PRE-STRESS IN PRE-TENSIONED MEMBERS (9)
Transmission of pre-stressing force by bond, Transmission length, Flexural bond stresses, IS code provisions, Anchorage zone stresses in post tensioned members, stress distribution in End block, Analysis by Guyon, Magnel, Zielinski and Rowe's methods, Anchorage zone reinforcement, BIS Provisions.

MODULE -V: COMPOSITE BEAMS AND DEFLECTIONS (9)
Different Types: Propped and Unpropped, stress distribution, Differential shrinkage, Analysis of composite beams, General design considerations. Deflections: Importance of control of deflections, Factors influencing deflections, short term deflections of uncracked beams, prediction of longtime deflections, BIS code requirements.

V. TEXTBOOKS:

1. N. Krishna Raju, "*Pre-stressed Concrete*", Tata McGraw Hill Book Education Pvt. Ltd, 6th Edition, 2018.
2. N. Rajagopalan, "*Prestressed Concrete*", Alpha Science International Ltd, 2nd edition, 2005.

VI. REFERENCE BOOKS:

1. Lin, T. Y., and Ned H. Burns. "*Design of Prestressed Concrete Structures".* John Wiley & Sons, 3rd edition, 1981.
2. Ramamrutham, S. "*Prestressed Concrete".* Dhanpat Rai Publishing Company (P) Ltd., 1975.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105106118
2. https://odp.inflibnet.ac.in/index.php/moduledetails?course=prestressed%20concrete%20structures&source=swayam&subsource=NPTEL

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

INTRODUCTION TO MACHINE LEARNING AND DEEP LEARNING								
III Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE27	Elective	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Probability and Statistics								

I. COURSE OVERVIEW:

This course introduces the concepts of machine learning and data analytics with applications in civil engineering. It covers supervised and unsupervised learning algorithms, neural networks, big data tools, and visualization platforms. Students will learn to apply machine learning techniques for tasks such as structural health monitoring, soil classification, traffic state prediction, and construction data management. Emphasis is placed on real-world applications, use of big data frameworks, and practical implementation through modern AI/ML libraries and visualization tools.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Foundations in machine learning and data analytics concepts relevant to civil engineering.
II. Big data processing frameworks and tools for handling large-scale civil engineering datasets.
III. Visualization techniques to interpret and communicate engineering data insights.
IV. The ML/DL algorithms for solving real-world civil engineering problems through projects.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the fundamentals of machine learning and data analytics and their importance in modern civil engineering.
CO 2 Apply supervised and unsupervised machine learning algorithms to solve classification and clustering problems in civil engineering.
CO 3 Implement neural network architectures (CNN, RNN, LSTM, GANs) for image-based and time-series applications in structural, geotechnical, and transportation engineering.
CO 4 Utilize big data processing tools (Hadoop, Spark, Pig, Hive) for analyzing large-scale civil engineering datasets.
CO 5 Develop effective data visualization and interpretation using tools such as Tableau, Power BI, and deep learning frameworks.
CO 6 Analyze real-world case studies and projects to identify suitable ML/DA methods for solving civil engineering challenges.

IV. COURSE CONTENT:

MODULE –I: INTRODUCTION (9)
Introduction to machine learning and data analytics in civil engineering: fundamentals, tools, history necessities, machine learning in modern civil engineering; recapitulation of linear regression, logistic regression

MODULE -II: APPLIED LEARNING MODELS (9)
supervised algorithms such as k-nearest neighbor, support vector machines, neural networks fundamentals and backpropagation, applications to structural damage detection, soil classification, etc.; unsupervised clustering algorithms such as hierarchical clustering, k-means and DBSCAN, applications on transportation mode inference, level of service of roads.

MODULE -III: DEEP LEARNING (9)
Introduction and fundamentals of convolutional neural network, image classification and object detection, applications to camera-based classification and object detection related to structural health monitoring, vehicle detection, etc.

Recurrent neural networks, long-short term memory, applications to traffic state prediction (speed/volume), soil strength prediction, rainfall-runoff modelling, etc.; variational autoencoder, generative adversarial networks, applications to sensor data generation and imputation such as traffic sensors, fault diagnostics in structural health monitoring.

MODULE -IV: BIG DATA (9)
Map reduce fundamentals (key-value), interface, algorithms (matrix multiplication, sorting, etc.), relevant tools such as apache pig, hive, spark fundamentals, spark streaming, applications to large-scale traffic trajectory data analysis, building information modelling in construction industry, etc.

MODULE -V: DATA VISUALIZATION TOOLS (9)
large-scale data visualization using Tableau, Power BI; deep learning tools such as keras, pytorch. Students will carry out a project applying the tools/algorithms covered in the course on a topic of their choice of interest.

V. TEXTBOOKS:

1. Ethem Alpaydin, "*Introduction to Machine Learning*", MIT Press, 4th Edition, 2020.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "*Deep Learning*" MIT Press, 2016.
3. Jure Leskovec, Anand Rajaraman, Jeffrey Ullman, "*Mining of Massive Datasets*", Cambridge University Press, 3rd Edition, 2020.
4. Christopher M. Bishop, "*Pattern Recognition and Machine Learning*", Springer, 2006.

VI. REFERENCE BOOKS:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "*The Elements of Statistical Learning*", Springer, 2nd Edition, 2017.
2. Andreas C. Müller, Sarah Guido, "*Introduction to Machine Learning with Python*", O'Reilly, 2017.
3. Aurélien Géron, "*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*", O'Reilly, 3rd Edition, 2022.
4. Foster Provost, Tom Fawcett, "*Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking*", O'Reilly, 2013.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/106106139
2. https://nptel.ac.in/courses/106106184
3. https://nptel.ac.in/courses/106106179
4. Scikit-learn: https://scikit-learn.org – Python ML library.

VIII. MATERIAL ONLINE:

1. Course Outline Description

2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

THEORY OF PLASTICITY AND FRACTURE MECHANICS								
III Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE28	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Construction Materials, Concrete Materials								

I. COURSE OVERVIEW:

This course introduces the principles of plasticity, components of stresses and strains, differential equations of equilibrium, boundary conditions, compatibility conditions and stress function. This course also covers the two-dimensional problems in rectangular coordinates and polar coordinates, Fourier series for two-dimensional problems stress distribution symmetrical about an axis, pure bending of curved bars, strain components in polar coordinates, displacements for symmetrical stress distributions, simple symmetric and asymmetric problems, analysis of stress strain in three dimensions, torsion of prismatic bars and plasticity.

IV. COURSE OBJECTIVES:

The students will try to learn:

I. Foundations in machine learning and data analytics concepts relevant to civil engineering.
II. Big data processing frameworks and tools for handling large-scale civil engineering datasets.
III. Visualization techniques to interpret and communicate engineering data insights.
IV. The ML/DL algorithms for solving real-world civil engineering problems through projects.

V. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the fundamentals of machine learning and data analytics and their importance in modern civil engineering.
CO 2 Apply supervised and unsupervised machine learning algorithms to solve classification and clustering problems in civil engineering.
CO 3 Implement neural network architectures (CNN, RNN, LSTM, GANs) for image-based and time-series applications in structural, geotechnical, and transportation engineering.
CO 4 Utilize big data processing tools (Hadoop, Spark, Pig, Hive) for analyzing large-scale civil engineering datasets.
CO 5 Develop effective data visualization and interpretation using tools such as Tableau, Power BI, and deep learning frameworks.
CO 6 Analyze real-world case studies and projects to identify suitable ML/DA methods for solving civil engineering challenges.

IV. COURSE CONTENT:

MODULE-I: STRESS (10)

Introduction to Elasticity, Definition of Kinetics and Kinematics, Notation for forces and stress, Components of stresses, Stress tensor, Differential equations of equilibrium in 2D & 3D in Cartesian coordinates and in polar coordinates, boundary conditions, Cauchy's postulate, Stress transformation, Direction Cosines, Principal stresses, Stress invariants, Decomposition of stresses-Hydrostatic and Deviatoric stresses, Octahedral stresses, stress concentration factors

MODULE-II: STRAIN (10)

Notation for strain, Components of strain, Strain tensor, Strain Components, Strain - displacement relations, Strain Compatibility Conditions, Strain transformation, Direction Cosines, Principal strains, Strain invariants, Octahedral strains, Strain Rosette

MODULE-III: STRESS -STRAIN RELATIONSHIP (10)

Navier's equation for stress-strain relationships, Relationship between Material constants, Stress, strain relations in 2D and 3D, Complementary conditions for shear, Material symmetry

Reduction of Material constants from anisotropic to orthotropic, monoclinic, isotropic and transversely isotropic, Plane stress, Plane strain and axi-symmetric idealizations, Mohr circle in 2D and 3D, Airy's stress function, Potential function

MODULE-IV: PLASTICITY (9)

Introduction to plasticity, Yield criteria for pressure dependent and independent materials, Tresca's criterion, Von mises criterion, Mohr-Coulomb criterion, Rankine criterion, Flow rule, Associative and Non-Associative, hardening rules and consistency conditions, Introduction to iterative and return mapping. Methods- pumping, well points, bored wells, electro-osmosis, injections with cement, clays and chemical, freezing process, vibro-flotation.

MODULE-V: FRACTURE MECHANICS PRINCIPLES (9)

Introduction sources of micro and macro cracks fracture criterion based on stress concentration and theoretical strength Griffith's energy, Balance approach, subsequent modifications, stress intensity factor approach. Stress Analysis for Members with Cracks: Linear elastic fracture mechanics crack tip stresses and deformations, relation between stress intensity factor and fracture toughness stress intensity-based solutions, 3-D cracks.

V. TEXTBOOKS:

1. Timoshenko, S. P., and J. N. Goodier. "*Theory of Elasticity",* McGraw-Hill, 3rd Edition, 1970.
2. Fung, Yuan-Cheng. "*Foundations of Solid Mechanics",* Prentice-Hall, 1965.

VI. REFERENCE BOOKS:

1. Sadd, Martin H. *Elasticity: Theory, Applications, and Numerics*. Academic Press, 5th Edition, 2020.
2. Sadhu Singh. "*Theory of Elasticity",* Khanna Publishers, New Delhi, 2012.

VII. ELECTRONICS RESOURCES:

1. https://www.sciencedirect.com/topics/materials-science/plasticity-theory
2. https://novapublishers.com/shop/fracture-mechanics-advances-in-research-and-applications

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE29	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Reinforced Concrete Design								

I. COURSE OVERVIEW:

This course provides a comprehensive understanding of earthquake engineering principles and their application in the seismic design of buildings. It covers the fundamentals of engineering seismology, conceptual design philosophies, seismic analysis methods, earthquake-resistant design of reinforced concrete and masonry structures, and the design of shear walls with ductility considerations. Emphasis is placed on Indian Standards (IS 1893, IS 13920, IS 4326) and capacity-based design principles to ensure structural safety and resilience against earthquakes.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Fundamentals of engineering seismology and seismic characteristics influencing building behavior.
II. Conceptual design principles ensuring safety, symmetry, and ductility in earthquake-resistant structures.
III. Methods for analyzing and designing RC and masonry buildings as per IS codes, addressing irregularities and structural walls.
IV. Importance of shear walls, ductility, and capacity design for achieving enhanced earthquake resistance.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the fundamentals of engineering seismology, seismic waves, earthquake measurement, and seismic zoning in India.
CO 2 Apply conceptual design principles to achieve strength, stiffness, ductility, and stability in earthquake-resistant structures.
CO 3 Analyze structures using static and dynamic methods (Equivalent Lateral Force, Response Spectrum) as per IS 1893.
CO 4 Design RC buildings, masonry walls, and structural walls for seismic loads considering irregularities and nonstructural elements,
CO 5 Design rectangular and flanged shear walls and evaluate the behavior of coupled shear walls under seismic loading.
CO 6 Apply ductility and capacity design principles to beams, columns, and joints in RC structures, ensuring earthquake resilience.

IV. COURSE CONTENT:

MODULE –I: ENGINEERING SEISMOLOGY (9)

Engineering Seismology: Earthquake phenomenon cause of Earthquakes-Faults- Plate tectonics- Seismic waves-Terms associated with Earthquakes-Magnitude/Intensity of an earthquake-scales- Energy Released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph- Characteristics of strong ground motions- Seismic zones of India. Introduction-Functional Planning-Continuous Load Path-Overall form-simplicity and symmetry elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

MODULE -II: CONCEPTUAL DESIGN (9)

Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures. Twisting of Buildings – Flexible Building and Rigid Building Systems. Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete - Design Earthquake Loads – Basic Load Combinations – Permissible Stresses. Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method.

MODULE -III: EARTHQUAKE RESISTANT DESIGN (9)

Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods. RC Buildings – IS Code based Method. - Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear – Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes.

Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls – Non-Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures.

MODULE -IV: DESIGN OF SHEAR WALLS (9)

Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls, Derivation of Formula for Moment of Resistance of Rectangular Shear walls – Behaviour of Coupled Shear Walls.

MODULE -V: DUCTILITY CONSIDERATIONS (9)

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility-Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during Earthquakes-Vulnerability of open ground storey and short columns during earthquake. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns- Case studies.

V. TEXTBOOKS:

1. S.K.Duggal, "*Earthquake Resistant Design of Structures*", Oxford publishers, 2nd Edition 2013.
2. Agarwal, P. & Shrikhande, M., "*Earthquake Resistant Design of Structures*", Prentice Hall of India, 2006.
3. Chopra, A.K., "*Dynamics of Structures: Theory and Applications to Earthquake Engineering*", 5th Edition, Pearson Education, 2017.
4. IS 1893 (Part 1): 2016 – Criteria for Earthquake Resistant Design of Structures. Bureau of Indian Standards, New Delhi.
5. IS 13920: 2016 – Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces. Bureau of Indian Standards, New Delhi.

VI. REFERENCE BOOKS:

1. Paulay, T. & Priestley, M.J.N., "*Seismic Design of Reinforced Concrete and Masonry Buildings"*. John Wiley & Sons, 1992.
2. Dowrick, D.J. "*Earthquake Resistant Design and Risk Reduction*", 2nd Edition. Wiley, 2009.

3. Clough, R.W. & Penzien, J., "*Dynamics of Structures*", McGraw-Hill, 2003.
4. Murty, C.V.R. "*Earthquake Tips: Learning Earthquake Design and Construction"*. IIT Kanpur, India., 2010.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105101004
2. https://nptel.ac.in/courses/105106151

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

COST MANAGEMENT OF ENGINEERING PROJECTS								
III Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE30	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Construction Process, Costs involved in Construction, Basic Management.								

I. COURSE OVERVIEW:

Cost Management of Engineering Projects provides a comprehensive understanding of planning, estimating, budgeting, monitoring, and controlling costs throughout the project life cycle. The course emphasizes various costing systems, cost behavior, and cost allocation methods essential for effective decision-making. It covers project planning, execution, and control strategies to ensure projects are completed within budget while meeting quality standards. Students will learn about different types of costs, budgeting techniques, forecasting, and performance measurement tools. The course also integrates quality management principles and modern cost optimization techniques, enhancing career potential in project management, construction, manufacturing, and engineering industries.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The knowledge of Cost Management processes and Costing Systems.
II. The ability to understand the basic concepts of Project Planning, Execution, and Cost Control.
III. The skill to discuss various types of costs, their behavior, and the role of Quality Management.
IV. The capability to identify different types of Budgets involved in the Cost Management process.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Understand the principles of cost management and the functioning of different costing systems used in engineering projects.
CO 2 Understand the concepts of project planning, scheduling, and execution in relation to cost control.
CO 3 Apply knowledge of various types of costs and their behavior in analyzing project expenditures.
CO 4 Understand the importance of quality management and its integration with cost management practices.
CO 5 Analyze cost variations and financial data to identify factors influencing project overruns.
CO 6 Apply cost control tools and techniques to optimize resources and enhance the efficiency of project execution.

IV. COURSE CONTENT:

MODULE –I: Introduction to CMEP (10)
Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost, Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making

MODULE -II: Project: Meaning (9)
Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

MODULE -III: Cost Behavior and Profit Planning (9)
Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making.

problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

MODULE -IV: Budgetary Control (09)

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

MODULE -V: Quantitative techniques for cost management (09)
Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

V. TEXTBOOKS:

1. B. N. Dutta, "*Estimating and Costing*", UBS publishers,20119.
2. G. S. Birdie., "*Estimating and Costing*", Dhanpat Rai publications,2021.
3. Ghalot, P.S., Dhir,D. M., "*Construction Planning and Management*", Wiley Eastern Limiled,1992.
4. Chitkara,K K., "*Construction Project Management*". Tata McGraw Hill Publishing Co, Ltd., New Delhi, 1998.
5. Punmia,B. C., "*Project Planning and Control with PERT and CPM*", Laxmi Publications, New deIhi,1987.

VI. REFERENCE BOOKS:

1. Horngren, Charles T., Srikant M. Datar, and Madhav V. Rajan. "*Cost Accounting: A Managerial Emphasis",* Prentice Hall of India, 16th Edition, New Delhi, 2017.
2. Kaplan, Robert S., and Anthony A. Atkinson. "*Advanced Management & Cost Accounting"*. Prentice Hall, 3rd Edition 1998.
3. Bhattacharyya, Ashish K. "*Principles and Practice of Cost Accounting"*. A.H. Wheeler & Co. Pvt. Ltd. 3rd Edition, New Delhi, 2009.

VII. ELECTRONICS RESOURCES:

1. https://en.wikipedia.org/wiki/Estimation
2. https://theconstructor.org/practical-guide/quality-control
3. https://nptel.ac.in/courses/105106149

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments

4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

WASTE TO ENERGY								
III Semester: STE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE31	**Elective**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

Waste to Energy focuses on sustainable conversion of solid and liquid waste into usable forms of energy through advanced technologies and integrated waste management strategies. This course provides an overview of waste characterization, treatment processes, and energy recovery methods in line with national and international environmental standards. It emphasizes efficiency, environmental safety, and sustainability by integrating modern thermal, biochemical, and thermo-chemical technologies for power generation and fuel production. Topics include sources and classification of wastes, waste collection and segregation, incineration, gasification, pyrolysis, anaerobic digestion, landfill gas recovery, and emission control systems. The course also covers techno-economic analysis, policy frameworks, and case studies of successful waste-to-energy projects, ensuring resource recovery, circular economy adoption, and reduction of environmental pollution for long-term energy security.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals of waste generation, classification, and characterization, and their significance in sustainable energy recovery and environmental protection.
II. Various waste-to-energy conversion processes such as incineration, gasification, pyrolysis, and anaerobic digestion, including their efficiency, emission characteristics, and technological requirements.
III. Principles of energy recovery, material recycling, and pollution control using modern thermal, biochemical, and thermo-chemical technologies in line with environmental standards.
IV. Case studies of maintenance, rehabilitation, and seismic retrofitting projects for identifying effective practices, challenges, and strategies in extending structural life cycles.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Identify the different sources and types of solid waste by the properties of municipal solid waste for segregation and collection of waste.
CO 2 Evaluate biochemical and thermo-chemical waste-to-energy conversion processes for their efficiency and applicability.
CO 3 Apply principles of densification, heat recovery, and energy recovery from waste plastics to improve the efficiency of power plants for energy production.
CO 4 Analyze energy recovery from biogas and landfill gas for environmental benefits.
CO 5 Evaluate waste management activities including collection, segregation, transportation, and siting of centralized for sustainable operations.
CO 6 Utilize techno-economic analysis, industry-specific applications, and policy frameworks for feasibility, optimize performance and integrate waste-to-energy systems

IV. COURSE CONTENT:

MODULE –I: WASTE SOURCES & CHARACTERIZATION (9)
Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste, agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

MODULE -II: TECHNOLOGIES FOR WASTE TO ENERGY (9)
Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

MODULE -III: ENERGY PRODUCTION FROM SOLID WASTES (9)
Densification of solids, efficiency improvement of power plant and energy production from waste plastics. Densification of solids: principle, advantages, and disadvantages.

Efficiency improvement of power plants: principle, advantages, and disadvantages; Energy production from waste plastics: principle, advantages, and disadvantages; Applications of waste plastics in energy generation.

MODULE -IV: THERMO-CHEMICAL CONVERSION (9)
Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion, comparison of various thermo-chemical conversion.

MODULE -V: E-CENTRALIZED AND DECENTRALIZED WASTE TO ENERGY PLANTS (9)
Waste activities, collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications, In-house us, sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

V. TEXTBOOKS:

1. Nicholas P Cheremisinoff, "*Handbook of Solid Waste Management and Waste Minimization Technologies*", An Imprint of Elsevier, New Delhi, 2003.
2. Paul Breeze, "*Energy from Waste*", An Imprint of Elsevier, New Delhi, 2018.
3. P Aarne V esilind, William A Worrell and Debra R Reinhart, "*Solid Waste Engineering*", 2nd Edition 2002.

VI. REFERENCE BOOKS:

1. Challal, D S, "*Food, Feed and Fuel from Biomass*", IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.
2. C Y Were Ko-Brobby and E. B. Hagan, "*Biomass Conversion and Technology*", John Wiley & Sons, 1st Edition, 1996.
3. C Parker and T Roberts, "*Energy from Waste*", An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
4. KL Shah, "*Basics of Solid and Hazardous Waste Management Technology*", Prentice Hall, Reprint edition, 2000.

VII. ELECTRONICS RESOURCES:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, Ramzy Kahnat, Eric williams Tech. &Engg, 2013.
2. https://www.What is the impact of E-waste: Tamara Thompson.
3. https://www. E-waste poses a Health Hazard: Sairudeen Pattazhy.

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments

4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

INDUSTRIAL SAFETY								
III Semester: STE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTE32	**Elective**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

Industrial Safety focuses on the principles, practices, and regulations required to ensure safe working environments in industrial operations and processes. This course provides an overview of occupational hazards, accident causation, and safety management systems in line with national and international standards. It emphasizes risk assessment, hazard identification, and preventive strategies by integrating modern safety tools, monitoring technologies, and regulatory frameworks. Topics include industrial hazards and their control, fire and explosion prevention, electrical and mechanical safety, ergonomics, personal protective equipment (PPE), safety in material handling, emergency preparedness, and accident investigation.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals of industrial hazards, risk assessment, and accident causation theories, and their importance in ensuring workplace safety and sustainable industrial operations.
II. Different safety systems, hazard control measures, and emergency preparedness strategies, including their effectiveness, regulatory requirements, and technological applications.
III. Principles of occupational health, safety management systems, and modern monitoring tools to prevent accidents, ensure compliance, and promote safe working environments.
IV. Case studies of industrial accident investigations, disaster management, and safety audits to identify best practices, challenges, and strategies for improving industrial safety performance.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Identify causes, types, and control measures of accidents for understanding mechanical and electrical hazards.
CO 2 Analyze fire prevention methods, firefighting equipment, and safety color codes for minimizing workplace hazards and ensuring emergency preparedness.
CO 3 Evaluate maintenance engineering fundamentals, maintenance types, and cost–replacement relations for improving equipment service life and plant reliability.
CO 4 Apply knowledge of wear mechanisms, lubrication methods, and corrosion prevention techniques for enhancing durability and reducing industrial component failures.
CO 5 Utilize hazard identification and risk assessment techniques such as JSA, FMEA, HAZOP, Fault Tree, and Event Tree analyses for systematic safety evaluation and risk mitigation.
CO 6 Implement periodic and preventive maintenance practices for effective inspection and long-term operational efficiency of mechanical and electrical systems.

IV. COURSE CONTENT:

MODULE –I: INDUSTRIAL SAFETY (9)

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

MODULE -II: FUNDAMENTALS OF MAINTENANCE ENGINEERING (9)

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

MODULE -III: WEAR AND CORROSION AND THEIR PREVENTION (9)

Wear- types, causes, effects, wear reduction methods, Lubricants - types and applications, Lubrication methods, general sketch, working and applications, Screw down grease cup, Pressure grease gun, Splash lubrication.

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

MODULE -IV: HAZARD IDENTIFICATION TECHNIQUES (9)

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment.

MODULE -V: PERIODIC AND PREVENTIVE MAINTENANCE (9)

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

V. TEXTBOOKS:

1. Reese, Charles D., and James Vernon Eidson. "*Handbook of OSHA construction safety and health*." crc press, 2006.
2. Higgins, Lindley R., R. Keith Mobley, and Darrin Wikoff. "*Maintenance engineering handbook"*. McGraw-Hill Education, 2008.

VI. REFERENCE BOOKS:

1. R.K. Jain and Prof. Sunil S. Rao, "*Industrial Safety, Health and Environment Management Systems*" Khanna Publisher.
2. Frank Lees "*Loss Prevention in Process Industries"*. Butterworth-Heinemann publications, UK, 4th Edition, 2012.

VII. ELECTRONICS RESOURCES:

1. https://nibmehub.com/opacservice/pdf/read/Industrial%20Safety%20and%20Health%20Management.pdf.
2. https://hsseworld.com/wp-content/uploads/2020/08/Industrial-Safety-Management.pdf.

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ENERGY EFFICIENT BUILDINGS								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTE33	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

This course provides comprehensive knowledge of energy efficiency in buildings by integrating principles of building science, architecture, and indoor environmental quality. It emphasizes the assessment of thermal, visual, acoustical, and air quality factors influencing human comfort, along with ventilation strategies and their role in energy conservation and healthy indoor climates. The course explores passive and active heating/cooling techniques, solar energy utilization, and energy-efficient building services such as HVAC, lighting, and electrical systems. Energy management practices, including monitoring, targeting, energy audits, demand-side management, and landscape-based microclimate modifications, are introduced to enhance efficiency. Through analytical exercises and case studies, students gain practical exposure to evaluating the energy balance of buildings, retrofitting strategies, and the application of software tools to achieve sustainable, energy-efficient, and healthy built environments.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The principles of energy efficiency in buildings, including building science, indoor environment components, and the role of energy audits in reducing consumption.
II. Indoor environmental quality with respect to thermal, visual, acoustical, and air quality comfort, and assess the contribution of building services (HVAC, lighting) to energy performance.
III. Ventilation strategies, passive and active solar heating/cooling techniques, and energy-efficient technologies to improve building performance across various climatic zones.
IV. Energy management practices and analyze case studies to assess energy balance, retrofit opportunities, and software-based approaches for achieving sustainable, low-energy, and healthy buildings.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Understand the principles of energy efficiency in buildings, including building science, materials, and energy audit practices.
CO 2 Evaluate indoor environmental quality by analyzing thermal, visual, acoustical, and air quality comfort factors, and their impact on energy performance.
CO 3 Apply ventilation strategies, passive and active heating/cooling techniques, and energy- efficient technologies to reduce energy demand in buildings across different climatic zones.
CO 4 Analyze energy management practices such as monitoring, targeting, demand-side management, and energy conservation strategies in building systems.
CO 5 Demonstrate the ability to calculate and assess the energy balance of buildings through case studies, identifying opportunities and contradictions in energy efficiency and indoor climate.
CO 6 Develop independent problem-solving and reporting skills by investigating energy and indoor climate issues and presenting findings effectively in technical formats.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO ENERGY EFFICIENCY IN BUILDINGS (9)
Introduction to energy efficiency in buildings-Architecture- Building Science and its significance- Indoor Environment. Components of Indoor Environment - Classification of building materials based on energy intensity- Energy Management of Buildings and Energy Audit of Buildings.

MODULE-II: QUALITY OF INDOOR ENVIRONMENT (09)
Quality of Indoor Environment. Human Comfort-Thermal, Visual, Acoustical and Olfactory comfort. Concept of Sol- air temperature and its significance. Building technology and building services engineering (HVAC) Contribution to lower energy consumption, with different conditions for new and existing buildings.

MODULE-III: VENTILATION AND IS SIGNIFICANCE (9)
Ventilation and is significance. Cooling and heating concepts, Passive solar heating, active solar heating and solar electricity - Passive concepts appropriate for the various climatic zones in India- Electric efficiency for fans, pumps, lighting etc. Heat pumps. Heat exchangers. Experiences from existing energy efficient buildings.

Building related problems and health issues. Indoor climate issues regarding air quality, thermal indoor climate and acoustics. The importance of ventilation for energy efficiency and indoor climate. Building technology and calculations regarding moisture problems.

MODULE-IV: ENERGY MANAGEMENT (09)
Energy management matrix monitoring and targeting. Energy Efficient Landscape Design - Modification of microclimate through landscape elements for energy conservation, Energy conservation in lighting, HVAC, and building envelope. Energy auditing procedures and reporting. Demand-side management and load management strategies. Case studies of energy-efficient buildings and campuses.

MODULE-V: CASE STUDIES (9)
Case studies: Calculations of the energy balance of buildings without available energy calculation programs, primarily monthly calculations for residential buildings. Energy efficiency and conservation requirements for existing buildings, contradictions and opportunities. Energy efficiency and healthy buildings, contradictions and opportunities, Softwares.

V. TEXT BOOKS:

1. Sodha M. Bansal N.K., Bansal,P.K Kumar, A. and Malik, M.A.S., "*Solar Passive Buildings*", Pergamon Press, 1986.
2. Koenigs berger, O.H., Ingersoll, T.G., Mayhew Alan and Szokolay, S. V., "*Manual of Tropical Housing and Building part 1: Climatic Design*", OLBN 0 002120011, Orient Longman Limited, 1973

VI. REFERENCE BOOKS:

1. Levenspiel, Octave. "*Understanding Engineering Thermo. Upper Saddle River"*, NJ: Prentice Hall, 1996.
2. Ian M. Shapiro, "Energy Audits and Improvements for Commercial Buildings", John Wiley & Sons, 2016.
3. Lal Jayamaha (2006), Energy-Efficient Building Systems: Green Strategies for Operation and Maintenance, McGraw Hill Professional.

VII. ELECTRONICS RESOURCES:

1. https://elearning.iea.org/courses/course-v1:IEA+BUILDINGS1+Open/about
2. https://www.energy.gov/eere/energy-efficiency-buildings-and-industry

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II

6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

COURSE CONTENT

ENGLISH FOR RESEARCH PAPER WRITING								
III Semester: AE, CSE, ES, EPS, STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSE02	**Audit**	2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In this course, students will be equipped with the necessary tools to effectively communicate their research findings in a scholarly manner. They will develop the ability to write clear, concise, and well-structured research papers that adhere to academic standards. These skills will not only benefit them in their academic pursuits but also in their future professional careers as researchers, scholars, and professionals in various fields

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to improve the writing skills and level of readability.
II. The methodology that what to write in each section the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Interpret the technique of determining a research problem for a crucial part of the research study
CO 2 Examine the way of methods for avoiding plagiarism in research
CO 3 Apply the feasibility and practicality of research methodology for a proposed project.
CO 4 Make use of the legal procedure and document for claiming patent of invention.
CO 5 Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP

IV. COURSE CONTENT:

MODULE – I: PLANNING AND PREPARATION

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

MODULE – II: ABSTRACT

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

MODULE – III: DISCUSSION AND CONCLUSIONS

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

MODULE – IV: DISCUSSION AND CONCLUSIONS

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

MODULE – V: QUALITY AND TIME MAINTENANCE

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

V. TEXT BOOKS:

1. Goldbort R, “Writing for Science”, Yale University Press. 2011.
2. Adrian Wallwork, “English for Writing Research Papers”, Springer New York Dordrecht Heidelberg London, 2011.

VI. REFERENCE BOOKS:

1. Highman N, “Handbook of Writing for the Mathematical Sciences”, SIAM Highman’s Book.

VII. WEB REFERENCES:

http://saba.kntu.ac.ir/eecd/ecourses/Seminar90/2011%20English%20for%20Writing%20Research%20Papers.pdf

VIII. E-TEXT BOOKS:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

COURSE CONTENT

DISASTER MANAGEMENT								
III Semester: AE, CSE, ES, EPS, STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSE03	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In the course on disaster management, students will explore a range of important topics and gain valuable knowledge and skills to effectively address and mitigate the impact of disasters and covers areas like Repercussions of Disasters and Hazards, Disaster-Prone Areas in India, Risk Assessment and Disaster Mitigation

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
II. How critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
III. The understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
IV. The strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Understand to describe the basic types of Environmental hazards and disasters. Understand how to react effectively to natural, manmade, and technological threats.
CO 2 Understand how to react effectively to natural, manmade, and planetary hazards
CO 3 Explore the history of the field and comprehend how past events are earthquake, landslides, and volcanic hazards.
CO 4 Describe the basic concepts of the emergency management cycle mitigation, preparedness, response, and recovery
CO 5 Recognizes the stakeholders in disaster management system, their jurisdiction and responsibilities

IV. COURSE CONTENT:

MODULE – I: INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

MODULE – II: REPERCUSSIONS OF DISASTERS AND HAZARDS
Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease And Epidemics, War And Conflicts.

MODULE – III: DISASTER PRONE AREAS IN INDIA
Study of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

MODULE – IV: DISASTER PREPAREDNESS AND MANAGEMENT
Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

MODULE – IV: RISK ASSESSMENT & DISASTER MITIGATION
Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

V. TEXT BOOKS:
1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal Book Company.

VI. REFERENCE BOOKS:
1. Sahni, PardeepEt.Al, "Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
2. Goel S. L. "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

VII. WEB REFERENCE:
1. http://nptel.ac.in/courses/105101010/downloads/Lecture37.pdf

VIII. E-TEXT BOOKS:
1. Disaster management by Vinod k. Sharma

COURSE CONTENT

SANSKRIT FOR TECHNICAL KNOWLEDGE								
III Semester: AE, CSE, ES, EPS, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSE04	**Audit**	2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In this course, Studying Sanskrit enhances students' analytical thinking and problem-solving abilities. The intricate grammar and logical structure of Sanskrit nurture their analytical skills, enabling them to dissect complex concepts and extract profound insights. This heightened analytical thinking can be applied across different technical disciplines, fostering innovative solutions to contemporary challenges

II. COURSE OBJECTIVES:

The students will try to learn:

I. A working knowledge in illustrious Sanskrit, the scientific language in the world.
II. The Sanskrit to improve brain functioning.
III. The Sanskrit language to develop the logic in mathematics, science & other courses enhancing the memory power.
IV. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to

CO 1 Understand the basic Sanskrit grammar
CO 2 Formulate simple sentences
CO 3 Apply order and roots
CO 4 Understand Ancient Sanskrit literature about science & technology
CO 5 Develop logical thinking being a logical language in technical concepts

IV. COURSE CONTENT:

MODULE – I: INTRODUCTION
Alphabets in Sanskrit, Past/Present/Future Tense.

MODULE – II: SENTENCES
Simple Sentences

MODULE – III: ROOTS
Order, Introduction of roots

MODULE – IV: SANSKRIT LITERATURE
Technical information about Sanskrit Literature

MODULE – V: TECHNICAL CONCEPTS
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

V. TEXT BOOKS:
1. Suresh Soni, “India’s Glorious Scientific Tradition”, Ocean books (P) Ltd., New Delhi.

VI. REFERENCE BOOKS:
1. Dr.Vishwas, “Abhyaspustakam”, Samskrita-Bharti Publication, New Delhi.

VII. WEB REFERENCES:
1. http://learnsanskritonline.com/

VIII. E-TEXT BOOKS:
1. Prathama Deeksha-Vempati Kutumb Shastri, “Teach Yourself Sanskrit”, Rashtriya Sanskri Sansthanam, New Delhi Publication.

COURSE CONTENT

VALUE EDUCATION								
III Semester: AE, CSE, ES, EPS, STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSE05	**Audit**	2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In the course on value education, students emerge with a heightened sense of self-awareness, a strong moral foundation, and the skills necessary for personal and professional success. They are equipped with the knowledge and tools to navigate ethical challenges, contribute positively to society, and lead a purposeful and fulfilling life based on their core values and principles.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The value of education and self- development.
II. Imbibe good values in students.
III. The importance of character.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Understand the significance of ethical human conduct and self-development
CO 2 Adopt value-based living and holistic technologies to save nature
CO 3 Inculcate positive thinking, dignity of labor and religious tolerance
CO 4 Develop the overall Character and Competence through self-management
CO 5 Practice Self-control. Honesty through Studying effectively all religious messages

IV. COURSE CONTENT:

MODULE – I: VALUES AND SELF-DEVELOPMENT
Values and self-development. Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

MODULE – II: CULTIVATION OF VALUES
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

MODULE – III: PERSONALITY AND BEHAVIOR DEVELOPMENT
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

MODULE – IV: CHARACTER AND COMPETENCE
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.

MODULE – V: SELF CONTROL
All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

V. TEXT BOOKS:
1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

VI. WEB REFERENCES:
1. http://www.best-personal-development-books.com/personal-value-development.html
2. http://nptel.ac.in/courses/109104068/

VII. E-TEXT BOOKS:
1. R.P. Shukla, “Value education and human rights”.

COURSE CONTENT

CONSTITUTION OF INDIA								
III Semester: AE, CSE, ES, EPS, STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSE06	**Audit**	2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

The course on the Constitution of India provides students with a comprehensive understanding of the historical context, principles, and structure of the Indian Constitution. It explores the journey and philosophy behind the making of the Indian Constitution, highlighting the vision and ideals of the founding fathers.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The premises informing the twin themes of liberty and freedom from a civil right perspective.
II. The growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
III. The role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe historical background of the constitution making and its importance for building a democratic India.
CO 2	Understand the Constitutional Rights and duties
CO 3	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary
CO 4	Analyse the decentralization of power between central, state and local self-government.
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

IV. COURSE CONTENT:

MODULE – I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.

MODULE – II: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES (04)

Fundamental Rights, Right to Equality, Right to Freedom, right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

MODULE – III: ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive President, Governor, Council of Minister, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

MODULE – IV: LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zilla Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

MODULE – V: ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

V. TEXT BOOKS:

1. Dr. S. N. Busi, "Dr. B. R. Ambedkar framing of Indian Constitution", 1st Edition, 2015.
2. M. P. Jain, "Indian Constitution Law", Lexis Nexis, 7th Edition, 2014.

VI. REFERENCE BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

VII. WEB REFERENCES:

1. http://www.constitution.org/cons/india/p18.html

VIII. E-TEXT BOOKS:

1. https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text

COURSE CONTENT

PEDAGOGY STUDIES								
III Semester: AE, CSE, ES, EPS, STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSE07	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In this course in pedagogy studies, students gain a solid foundation in educational principles and practices. They develop a deep understanding of effective teaching and learning strategies, empowering them to create engaging and meaningful learning experiences for their future students. Whether pursuing a career in teaching or any other field that involves knowledge transfer, students emerge with the knowledge and skills to inspire and facilitate learning, making a positive impact on the lives of others.

II. COUSE OBJECTIVES:

The students will try to learn:

I. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
II. The critical evidence gaps to guide the development.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Identify the Methodology and conceptual framework of teacher's education
CO 2 Understand pedagogical practices are being used by teachers in formal and informal classrooms in developing countries
CO 3 Interpret the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners
CO 4 Classify the importance of class room practice, curriculum and learning in Professional Development.
CO 5 Summarize teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy

IV. COURSE CONTENT:

MODULE – I: INTRODUCTION
Introduction And Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and searching.

MODULE – II: THEMATIC OVERVIEW
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

MODULE – III: PEDAGOGICAL PRACTICES
Evidence on the effectiveness of pedagogical practices. Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

MODULE – IV: PROFESSIONAL DEVELOPMENT
Professional Development: alignment with classroom practices and follows up Support. Peer support. Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources
and large class sizes.

MODULE – V: RESEARCH GAPS
Research gaps and future directions, Research design**,** Contexts**,** Pedagogy**.** Teacher education**.** Curriculum and assessment**.** Dissemination and research impact.

V. TEXT BOOKS:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2), 245-261.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379.

VI. REFERENCE BOOKS:

1. AkyeampongK, "Teacher training in Ghana - does it count?" Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving Teaching and Learning of Basic Maths and
   Rreading in Africa: Does teacher preparation count?" International Journal Educational Development, 33 (3): 272–282.

VII. WEB REFERENCE:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.
2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell

VIII. E-TEXT BOOKS:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE CONTENT

STRESS MANAGEMENT BY YOGA								
III Semester: AE, CSE, ES, EPS, STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSE08	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In a course on stress management by yoga, engineering students learn a variety of yoga techniques and principles that promote physical, mental, and emotional well-being. These techniques include yoga postures (asanas), breathing exercises (pranayama), meditation, and relaxation techniques.

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to achieve overall health of body and mind.
II. How to overcome stress.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Understand Ashtanga yoga and its importance

CO 2 Identify the Dos and Do nots of Life by practicing the Yam and Niyam

CO 3 Interpret the Shaucha and its components

CO 4 Make use of breathing techniques and Asan and Pranayam

CO 5 Develop healthy mind in a healthy body thus improving social health also

IV. COURSE CONTENT:

MODULE – I: INTRODUCTION
Definitions of Eight parts of yoga. (Ashtanga)

MODULE – II: YAM AND NIYAM
Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha.

MODULE – III: SHAUCHA
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

MODULE – IV: ASAN AND PRANAYAM
Asan and Pranayam. Various yog poses and their benefits for mind & body

MODULE – V: BREATHING TECHNIQUES
Regularization of breathing techniques and its effects-Types of pranayam

V.TEXT BOOKS:
1. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

VI.REFERENCE BOOKS:
1. Janardan Swami, "Yogic Asanas for Group Tarining-Part-I", Yogabhyasi Mandal, Nagpur.

VII. WEB REFERENCES:
1. https://americanyoga.school/course/anatomy-for-asana/
2. https://www.yogaasanasonline.com/

VIII. E-TEXT BOOKS:
1. Todd A. Hoover, M. D. D., Ht, "Stress Management by Yoga".

COURSE CONTENT

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS								
II Semester: AE, CSE, ES, EPS, STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSE09	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In this course, students delve into various aspects of personal development and self-awareness. They learn techniques to improve self-confidence, self-esteem, and self-awareness, which are vital for thriving in their engineering careers. Students explore their strengths, weaknesses, values, and beliefs, enabling them to develop a clearer understanding of themselves and their goals.

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to achieve the highest goal happily.
II. How a person become with stable mind, pleasing personality and determination.
III. Awaken wisdom in students.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Summarize steps to develop personality with stable mind, pleasing manners and determination.

CO 2 Identify day to day work and duties for developing peace and prosperity as depicted in Geeta.

CO 3 Formulate the daily life style by depicting the verses from Bhagavatgeetha.

CO 4 Outline the verses of Shrimad Bhagavad Geetha for holistic development.

CO 5 Demonstrates personality development by verses of Bhagavatgeetha.

IV. COURSE CONTENT:

MODULE – I: HOLISTIC DEVELOPMENT
Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue),Verses- 52,53,59 (dont's),Verses- 71,73,75,78 (do's)

MODULE – II: BHAGWAD GEETA
Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48. Chapter 3-Verses 13, 21, 27, 35.

MODULE – III: BHAGWAD GEETA
Shrimad BhagwadGeeta: Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

MODULE – IV: BASIC KNOWLEDGE
Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68. Chapter 12 -Verses 13, 14, 15, 16,17, 18

MODULE – V: ROLE MODEL
Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39. Chapter18 – Verses 37,38,63

V. TEXT BOOKS:
1. P.Gopinath, "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", Rashtriya Sanskrit Sansthanam, New Delhi.

VI. REFERENCE BOOKS:
1. Swami Swarupananda, "Srimad Bhagavad Gita", Advaita Ashram (Publication Department), Kolkata.

VII. WEB REFERENCES:
1. http://openlearningworld.com/section_personality_development.html

VIII. E-TEXT BOOKS:
1. http://persmin.gov.in/otraining/UNDPProject/undp_UNITs/Personality%20Dev%20N%20DLM.pdf

UNDERTAKING BY STUDENT/PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the College regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr./Ms ---------- joining I Semester for the academic year 2025-26 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean of Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 75% in more than three courses will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the college.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of the institute.
5. I will concentrate on my studies without wasting time in the Campus / Hostel / Residence and attend all the tests to secure more than the minimum prescribed Class / Sessional marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the college premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the college campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the concerned HOD / Principal.
11. I hereby acknowledge that I have received a copy of MT25 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number