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 CATALOGUE AND SYLLABI
MT23

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2023 - 2024)

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 professionally competent and socially sensitive engineers, 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 eminent, competitive and dedicated civil engineers by imparting latest technical skills and ethical values to empower the students to play a key role in the planning and execution of infrastructural & developmental activities of the nation.

MISSION

To provide exceptional education in civil engineering through quality teaching, state-of-the-art facilities and dynamic guidance to produce civil engineering graduates, who are professionally excellent to face complex technical challenges with creativity, leadership, ethics and social consciousness.

OR

M1: Provide exceptional education in civil engineering through quality teaching, state–of –the art facilities and dynamic guidance.

M2: Produce civil engineering graduates, who are skillfully excellent.

M3: Encourage professionally to face complex technical challenges and entrepreneurship with creativity, leadership, ethics and social consciousness.

M.TECH - PROGRAM OUTCOMES (PO's)

Upon completion of M.Tech Degree, the students will be able to:

PO - 1	An ability to Independently carry out research/investigation and development work to so practical problems.
PO - 2	An ability to Write and present a substantial technical report/document.
PO - 3	Students should be able to demonstrate a degree of mastery over the area as per specialization of the program. The mastery should be at a level higher than the requirements the appropriate bachelor program
PO - 4	Capable to apply the core, multidisciplinary knowledge for understanding the problems structural engineering and allied fields.
PO - 5	Conceptualize and design civil engineering structures considering various socio-econor factors.
PO - 6	Engage in life-long learning for continuing education in research-level studies and professio development.

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“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 "MT23" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd semester starts usually in July and even semester in December.

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)

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2023 - 24)

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 structure to Choose Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system 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 / project work /mini project work with seminar/ viva / 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	CAD / CAM	Mechanical Engineering	CC
4	Embedded Systems	Electronics and Communication Engineering	ES
5	Computer Science and Engineering	Computer Science and Engineering	CS
6	Aerospace Engineering	Aeronautical Engineering	AE

5. TYPES OF COURSES

Courses in a program may be of four kinds: **Core, Elective, Open and Mandatory 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 four professional elective courses which suit their project work in consultation with the faculty advisor / mentor. In addition, one course from each of the two open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

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 each semester is 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/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. Each Semester shall be of 22 weeks of duration (inclusive of Examinations), with a minimum of 90 instructional days per semester.

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. The terms 'COURSE' and 'COURSE' imply the same meaning here and refer to 'Theory Course', or 'Lab Course', or ‘Design/Drawing Course', or 'Mini Project with Seminar', or ‘Dissertation’, as the case may be.

Before commencement of the class work, all the eligible 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 project work and / or non-submission of the project report by the end of the fourth semester, the candidate shall re-register by paying the semester fee for the project. In such a case, the candidate will not be permitted to submit the 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 Professional core courses, Professional elective courses, Audit courses, Open elective courses, Laboratory courses, Mini project with seminar, Phase-I Dissertation and Phase-II Dissertation.

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	2	2
7	Phase - I Dissertation	20	10
8	Phase - II Dissertation	32	16

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (04) + Professional Core Electives (05) + Open Electives (01)	04@3credits + 05 @ 3 credits + 01@3 credits	30
Total Laboratory Courses (04)	04@2credits	08
Mini Project with Seminar (01)	1@2credit	02
Research Methodology and IPR	1@2 credit	02
Phase-I Dissertation	1 @10credit	10
Phase-II Dissertation	1 @16credits	16
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 SEE shall be conducted for 60 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern shall be as defined below. Two full questions with 'either' 'or' choice will be drawn from each unit. Each question carries 12 marks. There could be a maximum of two / three sub divisions in a question.

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):

For each theory course the CIA shall be conducted by the faculty / teacher handling the course. CIA is conducted for a total of 40 marks, with 30 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). **Two CIE Tests are Compulsory** and sum of the two tests, along with the scores obtained in the assignment and AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty.

Table 4: Outline of the Continuous Internal Assessments (CIA – 1 and CIA – 2) and SEE

Activities	CIA - 1	CIA - 2	SEE	Total Marks
Continuous Internal Examination (CIE)	10 marks	10 marks		20 marks
Assignment / Quiz	05 marks	05 marks		10 marks
Alternative Assessment Tool (AAT)	05 marks	05 marks		10 marks
Semester End Examination (SEE)			60 marks	60 marks
Total	--	--	100 marks	

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

Assignment:

To improve the writing skills in the course an assignment will be evaluated for 05 marks. Assignment has to submit either at the end of the CIE1 or CIE2 for the questions provided by each course coordinator in that semester. Assignments to be handed in as loose paper collection stapled together at the top left corner. The assignment should be presented as a professional report. It must consist of a cover sheet, content page, and should have an introduction, a body, a conclusion or recommendation, and a reference page.

Quiz: It is online proctor based online examination conducted either at the end of the CIE1 or CIE2.

The choice of conduction of Assignment / Quiz in CIE1 or CIE2 is purely choice of course handling faculty.

Alternative Assessment Tool (AAT):

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning center. **The AAT may include,** Course related term paper, Technical seminar, Term paper, Case Study, Paper presentations conducted by reputed organizations relevant to the course etc.

The choice of selection of AAT is based on course handling faculty.

Note:

First mid-term examination shall be conducted on 50% of the syllabus, and the second mid-term 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 five questions (numbered from 1 to 5) carrying 12 marks each. Each of these questions is from each module and may contain sub-questions, for each question there will be an "either" "or" choice, which means, there will be two questions from each module, 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. Viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned – **10 marks.**
3. Internal practical examination conducted by the laboratory teacher concerned 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.
5. The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the Principal. The Semester End Examination held for 3 hours and total 60 marks are divided and allocated asshown 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

9.3 Project work

Normally, the project 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.

9.3.1 The student shall submit the project work synopsis at the end of III semester for Phase-I of project evaluation. The Phase-I Dissertation of project work 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.

9.3.2 The first phase of project work is to be carried out in IV semester for Phase –II of Project work. The student will be allowed to appear for final 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 / journal and produce the proof of acceptance of the paper from the organizers / publishers.

9.3.3 The student shall submit the project work in the form of dissertation at least four weeks ahead of the completion of the program. Head of the Department shall constitute an Internal Evaluation Committee (IEC) comprising of the Chairman BOS (PG), HOD and Supervisor/Guide. As per convenes of all meeting for open pre-submission seminar evaluation of the student. If the open pre-submission seminar by a student is not satisfactory, another seminar shall be scheduled within two weeks.

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

S. No	Project Phases	Mode	Evaluation Committee	Marks
1	Phase - I	Continuous evaluation at the end of III Semester	Supervisor / Guide	40
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, Supervisor / Guide and HOD.	60
Total (Phase – I)				**100**
3	Phase - II	An open pre-submission seminar by the student	The Internal Evaluation Committee (IEC) comprising of the Chairman, BOS (PG), HOD and Supervisor / Guide wherein the HOD convenes its meeting.	40
4		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.	60
Total (Phase-II)				**100**

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

9.3.5 The Principal shall schedule the End Semester Examination in project 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 duly certified by the guide and HOD during the Examination.

9.3.6 The project 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 project work evaluation will be declared by the Controller of Examinations 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 on Mini Project 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/Lab/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 COE shall invite external examiners to evaluate all the semester end examinations answer scripts on a prescribed date(s).

11.3 Laboratory examinations are conducted by involving external examiners.

11.4 Examinations Control Office headed by COE shall consolidate the marks awarded by internal and external examiners and award grades.

12. SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures:

i. Not less than 40% marks (16 out of 40 marks) for each theory course in the CIA.

ii. Not less than 40% marks (24 out of 60 marks) for each theory course in the SEE.

iii. A minimum of 50% marks (50 out of 100 marks) for each theory course considering both CIA and SEE.

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Laboratory / Mini project with Seminar / Dissertation Project, if s/he secures.

i. Not less than 40% marks (16 out of 40 marks) in the CIA.
ii. Not less than 40% marks (24 out of 60 marks) in the SEE.
iii. A minimum of 50% marks (50 out of 100 marks) considering both CIA and SEE.

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.

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 / 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 "SA" denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

13.5 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,

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

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.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

Where, S_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.

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

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 PHOTOCOPY / REVALUATION

A student, who seeks the revaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s) within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. 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, 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	≥ 7.75
First Class	6.75≤ CGPA < 7.75
Second Class	6.00≤ CGPA < 6.75

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 course to the fulfillment of all the academic requirements.

19. 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.

Semester End Examination 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. 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 70 % external and 30% 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.

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

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.

$$CGPA = \sum_{j=1}^{n} (C_i S_i) / \sum_{j=1}^{n} C_i$$

Where, S_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. Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a make up Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

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

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

22. 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.

23. 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.

24. Who takes Decisions on Academic matters?

The Governing Body 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.

25. 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.

26. Is there any mechanism for Grievance Redressal?
The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27. How many attempts are permitted for obtaining a Degree?
All such matters are defined in Rules & Regulation

28. 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 reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

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

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

31. 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.

32. 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 AERONAUTICALENGINEERING

(Autonomous)

COURSE CATALOGUE

REGULATIONS: MT-23

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										
BSTD01	Advanced Structural Analysis	PCC	Core	3	0	0	3	40	60	100
BSTD02	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
BHSD01	Research Methodology & IPR	--	--	2	0	0	2	40	60	100
	Audit Course - I	Audit - I	Audit	2	0	0	0	-	-	-
PRACTICAL										
BSTD11	Advanced CAD Laboratory	PCC	Core	0	0	4	2	40	60	100
BSTD12	Advanced Concrete Laboratory	PCC	Core	0	0	4	2	40	60	100
TOTAL				**16**	**00**	**08**	**18**	**280**	**420**	**700**

***Professional Elective- I and Professional Elective- I Lab must be of same course.**

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										
BSTD13	Finite Element Analysis	PCC	Core	3	0	0	3	40	60	100
BSTD14	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										
BSTD23	Structural Design Laboratory	PCC	Core	0	0	4	2	40	60	100
BSTD24	Numerical Analysis Laboratory	PCC	Core	0	0	4	2	40	60	100
BSTD25	Mini Project with Seminar	PCC	Core	0	0	4	2	40	60	100
TOTAL				**14**	**00**	**12**	**18**	**280**	**420**	**700**

*** Professional Elective- III and Professional Elective- III Lab must be of same course**

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										
BSTD34	Dissertation Work Review - II	Major Project	Core	0	0	12	6	40	60	100
TOTAL				**06**	**00**	**12**	**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
BSTD35	Dissertation Work Review - III	Major Project	Core	0	0	12	6	40	60	100
BSTD36	Dissertation Viva-Voce	--	Core	0	0	28	14	40	60	100
TOTAL				**00**	**00**	**40**	**20**	**80**	**120**	**200**

ELECTIVE COURSES

PROFESSIONAL CORE ELECTIVES (PCE)

S.No	Course Code	Course Name	Professional Electives
1	BSTD03	Analytical and Numerical Methods for Structural Engineering	I
2	BSTD04	Advanced Concrete Technology	I
3	BSTD05	Structural Optimization	I
4	BSTD06	Non-destructive testing and Structural Evaluation	I
5	BSTD07	Theory of Plates and Shells	II
6	BSTD08	Theory and Applications of Cement Composites	II
7	BSTD09	Theory of Structural Stability	II
8	BSTD10	Composite Materials for Structural Engineering	II
9	BSTD15	Design of advanced Concrete Structures	III
10	BSTD16	Design of High-Rise Structures	III
11	BSTD17	Design of Masonry Structures	III
12	BSTD18	Elements of Bridge Engineering	III
13	BSTD19	Advanced Steel Design	IV
14	BSTD20	Advanced Design of Foundations	IV
15	BSTD21	Design of Industrial Structure	IV
16	BSTD22	Rehabilitation and Retrofitting of Structures	IV
17	BSTD26	Design of Pre stressed Concrete Structures	V
18	BSTD27	Analysis of Laminated Composite Plates	V
19	BSTD28	Fracture Mechanics of Concrete Structures	V
20	BSTD29	Earthquake Resistant design of Buildings	V

OPEN ELECTIVE COURSES FOR OTHER DEPARTMENTS

S.No	Course Code	Course Name
1	BSTD30	Cost Management of Engineering Projects
2	BSTD31	Waste to Energy
3	BSTD32	Industrial Safety
4	BSTD33	Energy Efficient Buildings

AUDIT COURSES – I AND II

S.No	Course Code	Course Title
1	BHSD02	English for Research Paper Writing
2	BHSD03	Disaster Management
3	BHSD04	Sanskrit for Technical Knowledge
4	BHSD05	Value Education
5	BHSD06	Constitution of India
6	BHSD07	Pedagogy Studies
7	BHSD08	Stress Management by Yoga
8	BHSD09	Personality Development through Life Enlightenment Skills

SYLLABUS
(I - III SEMESTERS)

COURSE CONTENT

ADVANCED STRUCTURAL ANALYSIS								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD01	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Analysis of Structures								

I. COURSE OVERVIEW:

This course mainly deals with matrix analysis of structures. It begins with a review of the basic concepts of structural analysis and matrix algebra, and shows how the latter provides an excellent mathematical framework for the former. This is followed by detailed descriptions, and demonstrations through many examples, of how matrix methods can be applied to linear static analysis of skeletal structures (plane and space trusses; beams and grids; plane and space frames) by the stiffness method, and also the flexibility method. Also, it is shown how simple structures can be conveniently solved using a reduced stiffness formulation, involving far less computational effort. Finally, the analysis of elastic instability and second-order response is discussed.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The advanced techniques to know the behavior of structural elements courseed to both vertical and horizontal loads which are used for designing all types of structures.
II. The advanced matrix analysis of various structural elements for design purpose.
III. The Design independently civil engineering structures as per the requirements of client and provide detailed design drawings, quality control reports during construction for ensuring quality and economical structures.

III. COURSE OUTCOMES:

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

CO 1 Explain the concepts of the static and kinematic indeterminacy of structures for analyzing the structures courseed to different loads.
CO 2 Apply the concept of stiffness matrix equations in global coordinate system with boundary condition for analyzing member forces in beams and frame structures.
CO 3 Analyze continuous beams courseed to different loading conditions using the flexibility method for ensuring structural efficiency.
CO 4 Analyze portal frames for the symmetrical and unsymmetrical loading conditions using the force method for the economical design of structures.
CO 5 Analyze indeterminate beams and frames with different loading conditions using the Stiffness method for the design purpose.
CO 6 Analyze the frames know the maximum shear force and bending moments using approximate methods of analysis.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION TO MATRIX METHODS OFANALYSIS (09)

Static indeterminacy and kinematic indeterminacy, degrees of freedom, coordinate system, structure idealization, stiffness and flexibility matrices, element stiffness equations, elements flexibility equations, force - displacement equations for truss, beam

MODULE - II: TECHNIQUES FOR ASSEMBLY OF GLOBAL STIFFNESS MATRIX (10)
Assembly of stiffness matrix from element stiffness matrix, direct stiffness method, general procedure, bank matrix, semi bandwidth, computer algorithm for assembly by direct stiffness matrix method.

MODULE - III: FLEXIBILITY METHOD OF ANALYSIS (09)
Introduction to flexibility method, flexibility equations. Analysis of continuous beams with different loading conditions and Plane frames with symmetrical and unsymmetrical loads.

Analysis of plane truss courseed to axial loads and grids by flexibility methods.

MODULE - IV: STIFFNESS METHOD OF ANALYSIS (10)
Introduction to stiffness method, stiffness equations. Analysis of continuous beams with different loading conditions and Plane frames with symmetrical and unsymmetrical loads. Analysis of plane truss courseed to axial loads and grids by stiffness methods.

MODULE - V: APPROXIMATE METHODS OF ANALYSIS (10)
Analysis of multi-storey frames for lateral loads: Portal method and cantilever method; Analysis of multistorey frames for gravity (vertical) loads; Substitute frame method.

V. TEXT BOOKS:

1. G. S. Pandit and S.P. Gupta, "Structural Analysis – A Matrix Approach", McGraw Hill Education. 2nd edition, 2008.
2. C.S. Reddy, "Basic Structural Analysis", McGraw Hill Education, 3rd edition, 1994.
3. Ashok. K. Jain, "Advanced Structural Analysis", Nem Chand & Bros. 3rd edition, 2010.
4. J. Meek, "Matrix Methods of Structural Analysis", McGraw Hill Education.1st edition, 2011.
5. S S. Bhavikatti, "Finite Element Analysis", New Age International Pvt. Ltd., Publishers.1st edition, 2009.

VI. REFERENCE BOOKS:

1. Todd, J.D., "Structural Theory and Analysis", The Mac Million Press Ltd., New York, 1st edition, 1974.
2. Menon,D., "Advanced Structural Analysis", Narosa Publishing House, New Delhi, 1st edition, 2009.
3. McCarmac, J. and Elling, R. E., "Structural Analysis: A Classical and Matrix Approach", Harperand Row Publishers, 4th edition, 2007.

VII. ELECTRONICS RESOURCES:

1. https://archive.nptel.ac.in/courses/105/106/105106050/
2. https://nptel.ac.in/reviewed_pdfs/105106050/lec1.pdf
3. http://web.iitd.ac.in/~sbhalla/rc717.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

THEORY OF ELASTICITY AND PLASTICITY								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD02	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Theory of Structures								

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.f

II. COURSE OBJECTIVES:

The student will try to learn:

I. The transformation of stresses and strains in two and three-Dimensional problems related to structural elements.
II. The Engineering properties of materials, force-deformation and stress-strain relationships.
III. The plastic behaviour of deformable bodies in Cartesian coordinates and polar coordinates.

III. COURSE OUTCOMES:

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

CO 1 Explain theory of elasticity including strain/displacement and Hooke's law relationships for analyzing the structures with in elastic range.

CO 2 Develop constitutive relationships between stress and strain in linearly elastic solid for analyzing the stresses in the field.

CO 3 Analyze the Stresses and Strains, Strain Displacement and Compatibility Relations for Boundary Value Problems in the Principal Directions.

CO 4 Explain the general theorems in three dimensions for the analysis of stresses in structures.

CO 5 Explain the stress-strain relations for linearly elastic solids, and torsion for design purpose.

CO 6 Demonstrate the ability to analyze the structure using plasticity for efficient design of structures.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION (09)
Introduction: Elasticity, notation for forces and stresses, components of stresses, components of strain, Hooks law. Plane stress and plane strain analysis, plane stress, plane strain, differential equations of equilibrium, boundary conditions, compatibility equations, stress function, boundary condition.

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 (10)
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 (09)
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 (10)
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. TEXT BOOKS:

1. Timoshenko, "Theory of Elasticity", McGraw-Hill Publications, 3rd edition, 1970.
2. Atkin, Raymond John, and Norman Fox. "An introduction to the theory of elasticity". Courier Corporation, 2005.
3. Chakrabarty, Jagabanduhu. Theory of plasticity. Elsevier, 2012.

VI. REFERENCE BOOKS:

1. Y. C. Fung, "Theory of Elasticity", Dover Publications, 2008.
2. Mendelson, A, "Plasticity: Theory and Applications", Mac Millan and Company, New York.
3. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 1979.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105106049/77
2. https://lecturenotes.in/course/162/advanced-mechanics-of-solids-amos
3. http://nptel.ac.in/courses/105106049/pdf-assignments/main.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD03	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
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 Explain functional dependency and solve Laplace and Euler's equations.

CO 2 Obtain numerical solution of ordinary and partial differential equations.

CO 3 Develop integration method/s for structural analysis.

CO 4 Carry out interpolations and curve fitting

CO 5 Obtain solution of Eigen value problems and Fourier series for structural analysis.

CO 6 Apply iterative and transformation methods in structural engineering

IV. COURSE CONTENT:

MODULE - I: FUNDAMENTALS OF NUMERICAL METHODS (10)
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 (09)
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 (10)
Implicit & Explicit scheme, solution using Explicit method, Stability analysis of Explicit and Implicit scheme

MODULE - V: COMPUTER ALGORITHMS (10)
Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

V. TEXT BOOKS:

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, (Shaum Series), 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 Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

ADVANCED CONCRETE TECHNOLOGY								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD04	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Concrete Technology								

I. COURSE OVERVIEW:

Concrete is the most versatile construction material used all around the world. The study of concrete has become indispensable to the Civil engineering graduates to learn fundamental properties of fresh concrete, hardened concrete, strength and durability. Concrete technology provides a comprehensive coverage of the theoretical and practical aspects of the course and includes the latest developments in the field of concrete construction. It incorporates the latest Indian standard specifications and codes of practices for regulating concrete construction. The properties of concrete and its constituent materials, the role of various admixtures in modifying these properties to suit specific requirements and situations are also be studied. The course also provides the knowledge on mix design for producing most economical and durable concrete, it also enables the students to acquire knowledge on special and new generation concrete with their applications.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The fundamental properties of construction materials such as cement, aggregates and admixtures based on laboratory and filed tests for identifying material quality.
II. The factors influencing workability and methods involved in measuring workability of fresh concrete.
III. The application of special and new generation concrete by replacing traditional concrete for improving structural performance in real time.

III. COURSE OUTCOMES:

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

CO 1 Explain the basic physical and chemical properties of construction materials for determining quality of concrete.
CO 2 Outline the workability and manufacturing process of concrete for obtaining economical and durable concrete.
CO 3 Inspect the impact of water/cement ratio on strength and durability of concrete by measuring its hardened strength.
CO 4 Identify the materials and technics of repair for rehabilitation and retrofitting of structures.
CO 5 Develop the most economical and eco-friendly concrete mix based on standard methods for producing quality of concrete.
CO 6 Examine special concretes and new generation concrete for satisfying the future needs of industry in real time.

IV. COURSE CONTENT:

MODULE - I: MATERIALS FORMING CONCRETE (10)

Concrete making materials: cement, bogues compounds, hydration Process, types of cement, aggregates, gradation charts, combined aggregate, alkali silica reaction, admixtures, chemical and mineral admixtures.

MODULE - II: TESTS ON FRESH AND HARDENED CONCRETE (09)

Fresh and hardened Concrete: Fresh Concrete workability tests on concrete setting times of fresh concrete, segregation and bleeding. Hardened concrete: Abram's law, gel space ratios, maturity concept, stress behaviour, creep and shrinkage, durability tests on concrete, nondestructive testing of concrete.

MODULE - III: HIGH STRENGTH AND HIGH-PERFORMANCE CONCRETES (10)

High strength concrete, micro structure, manufacturing and properties, design of HSC using erintroyshaklok method, ultra-high strength concrete.

High performance concrete, requirements and properties of high-performance concrete, design considerations.

MODULE - IV: QUALITY CONTROL OF CONCRETE (09)

Concrete mix design: Quality control, quality assurance, quality audit, mix design method - BIS method

MODULE - V: SPECIAL CONCRETES (10)

Self-compacting concrete, polymer concrete, Fiber reinforced concrete- Requirements and Guidelines-advantages and applications, Light weight concrete, bacteria concrete, geo polymer concrete, self-curing concrete, recycled aggregate concrete.

V. TEXT BOOKS:

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: Micro Structure", ICI, Chennai, 2007

VII. ELECTRONICS RESOURCES:

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

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

STRUCTURAL OPTIMIZATION								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD05	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Linear Algebra and Calculus								

I. COURSE OVERVIEW:

Structural optimization is a discipline dealing with optimal design of load-carrying mechanical structures. A growing subfield of structural optimization is topology optimization, where a typical problem might be as follows: Given a predefined design domain (in two or three dimensions), some given supports in connection to the design domain, some given external loads, and a given material to be used, the problem consists of designing an optimal structure to carry the given loads. This should be done by finding the optimal subdomain, of the given design domain, to fill with material. The objective might be to minimize the total weight of the structure course to constraints on displacements and stresses in the structure under the given loads. In order to attack this problem numerically, the design domain is discretized by a finite element model. One thus considers a discretized universe'' in which for each individual discrete point.

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 Classify optimization and various techniques.

CO 2 Solve various linear and Non-linear problems.

CO 3 Solve a problem by geometric programming and dynamic programming.

CO 4 Apply plastic theory for various structural components

CO 5 Apply optimization to various structural elements

CO 6 Evaluate optimization to various structural elements

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION (10)
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 (09)
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 (10)
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 Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

NON-DESTRUCTIVE TESTING AND STRUCTURAL EVALUATION								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD06	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Concrete Technology								

I. COURSE OVERVIEW:

Non-destructive Testing (NDT) plays an extremely important role in quality control, flaw detection and structural health monitoring covering a wide range of industries. There are varieties of NDT techniques in use. This course will first cover the fundamental science behind the commonly used NDT methods to build a basic understanding of the underlying principles. It will then go on to cover the process details of each of these NDT methods. This course is devised to introduce the student to forms of discontinuities in the manufacturing and service life of a part. Students are provided with an understanding of how and why a specific Non-destructive Testing method is chosen and acquainted with visual inspection techniques and their correct use.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The importance of Non-destructive Testing (NDT) for evaluating Structural performance.
II. The application of modern techniques in existing structures for strengthening and demolition in real time situations.
III. The procedures for corrosion activity and permeability detection in concrete

III. COURSE OUTCOMES:

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

CO 1 Apply the various NDT techniques to identify the defects.

CO 2 Select the suitable NDT techniques for various defects

CO 3 Identifying the nature and quantifying the defects

CO 4 Understand the instruments and interpretation on techniques

CO 5 Familiarize with basic principles of electromagnetic NDT methods.

CO 6 Understand the special radiographic techniques and the various advantages and limitations of the processes.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION TO NON-DESTRUCTIVE TESTING (NDT) (10)

Basics of manufacturing processes and defects in concrete structures, testing of concrete: Quality control tests, partial destructive tests. Need of non-destructive testing, basic methods of NDT, scope and

application. Visual Inspection: Tools and Equipment's required, procedure, reporting, applications and Limitations.

MODULE - II: SURFACE HARDNESS TESTING AND REINFORCEMENT DETECTION (10)
Schmidt rebound hammer test: Equipment required, general procedure, applications, scope and limitations. Penetration resistance or winds or robe test: equipment, procedure, applications, scope and limitations. Electromagnetic testing for reinforcement detection: Equipment, procedure, applications, scope and limitations

MODULE - III: CORROSION ACTIVITY AND PERMEABILITY TESTS (10)
Half-cell electrical potential method: Equipment, procedure, applications, scope and limitations; Resistivity measurement: Equipment, procedure, applications, scope and limitations.

Carbonation depth measurement: Equipment, procedure, applications, scope and limitations; Permeability test: Equipment, procedure, applications, scope and limitations.

MODULE - IV: ULTRASONIC TESTING (09)
Pulse velocity test: Equipment, procedure, applications, scope and limitations, Ultrasound pulse echo: Equipment, procedure, applications, scope and limitations, Impact echo test: Equipment, procedure, applications, scope and limitations, Relative amplitude method: Equipment, procedure, applications, scope and limitations

MODULE - V: VOIDS, DEFECTS AND MOISTURE DETECTION (09)
Radiographic testing: Equipment, procedure, applications, scope and limitations, Ground penetrating radar: Equipment, procedure, applications, scope and limitations, Infrared thermography: Equipment, procedure, applications, scope and limitations.

V. TEXT BOOKS:

1. J Prasad, C. G. K. Nair, "Non-destructive testing and evaluation of material," Mcgraw Hill Education India Pvt.Ltd, 2011.
2. D. E. Bray and R. K. Stanley, "Nondestructive evaluation: A tool for design, manufacturing and service," CRC Press, 1996.

VI. REFERENCE BOOKS:

1. Balayssac, Jean-Paul, and Vincent Garnier, eds. Non-destructive testing and evaluation of civil engineering structures. Elsevier, 2017.

VII. ELECTRONICS RESOURCES:

1. www-pub.iaea.org/mtcd/publications/pdf/tcs-17_web.pdf
2. http://store.elsevier.com/Non-Destructive-Evaluation-of-Reinforced-Concrete-Structures/isbn-9781845699505/
3. http://www-pub.iaea.org/mtcd/publications/pdf/tcs-17_web.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

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**
BSTD07	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Analysis of Structures								

I. COURSE OVERVIEW:

Plates and shells exhibit two dimensional structural actions that result in stronger, thinner and lighter structures and therefore, have economic advantage. This has opened the scope for the wide use of such elements in all fields of engineering due to significant increase of strength/weight ratio. The exposure to this course and its completion are very essential in understanding the behavior of thin structures for their applications in design.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Formulation of differential equations for bending of thin rectangular and circular plates.
II. The theory of large deflection of plates for efficient and economical design.
III. The numerical techniques and tools for the complex problems in thin plates.

III. COURSE OUTCOMES:

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

CO 1 Analyse the analytical solutions for rectangular plates by using Navier and Levy's methods, distributed and concentrated loads
CO 2 Explain Governing differential equations in polar coordinate system of a annular plate courseed to different loading conditions for the design of thin plates.
CO 3 Examine the governing differential equation of rectangular plates on elastic foundations for the design of foundations.
CO 4 Outline the general theory in bending of cylindrical shell, simplified method for analysis and design of the shells.
CO 5 Solve the governing equation of plate bending under the combined action of in plane loading and lateral loads for the design of plates.
CO 6 Examine the buckling of rectangular plates by compressive forces acting in one and two directions for the analysis of plates.

IV. COURSE CONTENT:

MODULE-I: THIN RECTANGULAR PLATES (10)

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 (10)
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: BUCKLING OF THIN PLATES (10)
Buckling of plates: Governing equation for bending of plate under the combined action of in plane loading and lateral loads, buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate.

V. TEXT BOOKS:

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

COURSE CONTENT

THEORY AND APPLICATIONS OF CEMENT COMPOSITES								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD08	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Concrete Technology, Building Materials – Planning and Construction								

I. COURSE OVERVIEW:

Concrete as one of the conventional composite materials is invariably one of the most robust and versatile material. It performs extremely well under compression; however high strength concrete tends to be brittle. Concrete these days is modified in order to enhance its capacity for long term performance under harsh environmental & structural loads. Cement and concrete composites have made this possible. These composites comprise of binder or a matrix that binds together different types of fibers or fragments as per the requirements. The final product in form of composite is light, strong, flexible and more efficient in comparison to conventional composite i.e., concrete.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Formulation of constitutive behavior of composite materials: Ferro cement, SIFCON and fiber Reinforced Concrete by understanding their strain- stress behavior.
II. The concept of Estimating strain constants using theories applicable to composite materials.
III. The analysis and design of structural elements made of cement composites.

III. COURSE OUTCOMES:

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

CO 1 Explain the stress-strain and characteristics of Characteristics of Composite Materials

CO 2 Formulate the constitutive behaviour of various composite materials.

CO 3 Classify the materials based on orthotropic and anisotropic behaviour.

CO 4 Estimate elastic constants using theories applicable to composite materials.

CO 5 Analyse the structural elements made of cement composites as Ferro cement, SIFCON and fibre reinforced concrete.

CO 6 Design structural elements made of cement composites as Ferro cement, SIFCON and fibre reinforced concrete.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Classification and Characteristics of Composite Materials: Basic Terminology, Advantages. Stress-Strain Relations, Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic

Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

MODULE-II: MECHANICAL BEHAVIOUR (09)
Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness, Bounding Techniques of Elasticity, Exact Solutions, Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

MODULE-III: CEMENT COMPOSITES (10)
Types of Cement Composites, Terminology, Constituent Materials and their Properties, Composite Materials- Orthotropic and Anisotropic behavior.

Construction Techniques for Fibre Reinforced Concrete: Ferro cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing

MODULE-IV: MECHANICAL PROPERTIES OF CEMENT COMPOSITES (09)
Behavior of Ferro cement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion

MODULE-V: APPLICATION OF CEMENT COMPOSITES (10)
FRC and Ferro cement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behavior, Constitutive relationship, Elastic Constants. Analysis and Design of Cement Composite Structural Elements: Ferro cement, SIFCON and Fiber Reinforced Concrete

V. TEXT BOOKS:

1. Jones R. M," Mechanics of Composite Materials", Taylor and Francis, BSP Books, 2nd edition, 1998.
2. Pama R. P, "Ferrocement – Theory and Applications", IFIC, 1980.

VI. REFERENCE BOOKS:

1. Pama R. P, "Ferrocement – Theory and Applications", IFIC, 1980.
2. Swamy R.N, "New Concrete Materials", Blackie, Academic and Professional, Chapman & Hall, 1st edition, 1980.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/101104010/
2. http://nptel.ac.in/courses/105108124/pdf/Lecture_Notes/LNm11.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

THEORY OF STRUCTURAL STABILITY								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD09	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Analysis of Structures								

I. COURSE OVERVIEW:

Structural stability of the building is the condition of safely transferring the load on the building (Self weight of the building and Live load on the building like human loads, furniture load etc.). Failure occurs because of loads acting on the structure. A structure which will not topple over easily when acted upon by a load is said to be stable. This is very important because when the tilting force is removed, gravity pulls the structure back to its original position.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The fundamentals of stability of columns and frames for designing efficient structures.
II. The Assessment of buckling of thin-walled bars and lateral buckling of beams, rectangular plates
III. The concept of stability criteria for analyzing discrete and continuous systems.

III. COURSE OUTCOMES:

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

CO 1 Analyze the buckling of columns, beam-columns and find critical loads using energy methods.
CO 2 Analyze the buckling of columns, beam-columns and find critical loads non-energy methods.
CO 3 Analyze the lateral buckling of beams by energy and non-energy methods.
CO 4 Analyze the buckling of rectangular plates and for various boundary conditions.
CO 5 Find critical compressive loads for various boundary conditions.
CO 6 Analyze the buckling of axially loaded cylindrical shells.

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: STABILITY OF COLUMNS (10)

Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

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 (10)
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. TEXT BOOKS:

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

COURSE CONTENT

COMPOSITE MATERIALS FOR STRUCTURAL ENGINEERING								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD10	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Concrete Technology								

I. COURSE OVERVIEW:

Composite materials such as fiber-reinforced composites, aggregate composites, and natural fiber reinforced composites have been used widely in engineering structures in various industries. Composite laminates, especially fiber reinforced metal laminates (FRMLs) have been used extensively in aerospace structures. Composite laminates are materials that involve some combination on a macroscopic scale of two or more different primary structural engineering constituents such as polymers, metals, ceramics and glasses. This book presents current research from across the globe in the study of composite materials, including the effects of thermo-oxidation on composite materials and structures at high temperatures; damping in composite materials; fatigue and fracture of short fiber composites; and solutions for post buckling of composite beams.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The fundamental properties of composite materials for identifying material quality.
II. The importance of stresses and strains relation in composites materials for efficient design of composite structures.
III. The mechanical behavior of glass fibre-reinforced laminates in structural stiffening.

III. COURSE OUTCOMES:

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

CO 1 Explain the mechanical behavior of layered composites compared to isotropic materials.
CO 2 Apply constitutive equations of composite materials
CO 3 Explain the mechanical behavior at micro and macro levels
CO 4 Determine stresses and strains relation in composites materials.
CO 5 Identify, properties of fibre reinforcements, polymer matrix materials and commercial composites.
CO 6 Analyze and design the various special concrete structures.

IV. COURSE CONTENT:

MODULE - I: COMPOSITE MATERIALS (09)

Introduction: Requirements of structural materials, influence of nature of materials in structural form, Nature of structural materials- Homogeneous materials, composite materials.

MODULE - II: MACRO MECHANICAL PROPERTIES OF COMPOSITE LAMINAE (10)
Introduction, assumptions and idealizations, stress strain relationships for composite laminate, isotropic, orthotropic laminate, strength characteristics, basic concepts, strength hypothesis for isotropic and orthotropic laminate. Macro mechanical analysis of composite laminate: Introduction, assumptions and limitations, stiffness characteristics of glass reinforced laminate, stress- strain relationships in continuous, discontinuous fibre laminate, strength characteristics of glass reinforced laminate, strengths in continuous, discontinuous fibre laminate.

MODULE - III: BEHAVIOUR OF GLASS FIBRE-REINFORCED LAMINATES (10)
Introduction, stiffness characteristics of laminated composites, behavior of laminated beams and plates, strength characteristics of laminated composites, strength analysis and failure criteria, effect of inter laminar structures.

Glass reinforced composites: Introduction, continuously reinforced laminates, uni-directionally and multi directionally continuously reinforced laminates, discontinuously reinforced laminates, stiffness and strength properties.

MODULE-IV: GRP PROPERTIES RELEVANT TO STRUCTURAL DESIGN (09)
Glass reinforced plastics (GRP): Introduction, short-term strength and stiffness-tensile, compressive, flexural and shearing. Long term strength and stiffness properties, temperature effects, effect of fire, structural joints- adhesive, mechanical, combinational, transformed sections.

MODULE-V: DESIGN OF GRP BOX BEAMS (10)
Introduction, loading, span and cross-sectional shape, selection of material, beam manufacture, beam stresses, experimental behaviour, effect on beam performance, modulus of elasticity, compressive strength, I value, prevention of compression buckling failure, behaviour under long term loading. Design of stressed skinned roof structure: Introduction, loading and material properties, preliminary design, and computer analysis.

V. TEXT BOOKS:

1. Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara, “Analysis and performance of fiber composites”, John Wiley & Sons, Australia, Limited, 1980.
2. Isaac M. Daniel, OriIshai, “Engineering mechanics of composite materials”, Oxford University Press Volume 13, 2006.

VI. REFERENCE BOOKS:

1. M. Holmes & J. Just, “GRP in Structural Engineering”, Applied science publisher Ltd, 1983.
2. Manjunath Mukhopadhyay, “Mechanics of composite materials and structures”, Universities Press, 2005.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/112104168/L14.pdf
2. https://www.amazon.com/Analysis-Performance-Composites-Bhagwan-garwal/dp/0471268917

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

RESEARCH METHODOLOGY AND IPR								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSD01	**Core**	2	0	0	2	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

This course imparts research methodology and philosophy of intellectual property rights, including basic concepts employed in quantitative and qualitative research methods, Patents, Copyrights, and Trademarks. It provides the research framework, research methodology research design, and formulation hypothesis, sampling techniques, data analysis and report writing. It implies on research skills and intellectual property rights to encourage new creations, including technology, artwork, and inventions, that might increase economic growth.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Knowledge on formulate the research problem, characteristics of a good research and interpretation of collected data.
II. The importance of research ethics while preparing literature survey and writing thesis to achieve plagiarism free report.
III. The intellectual property rights such as patent, trademark, geographical indications and copyright for the protection of their invention done.

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 and scope of protection to create and extract value from IP.
CO 6 Defend the intellectual property rights throughout the world with the involvement of world intellectual property organization

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches

of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

MODULE-II: RESEARCH ETHICS (09)
Effective literature studies approaches, analysis Plagiarism and Research ethics.

MODULE-III: RESEARCHPROPOSAL (09)
Effective technical writing, how to write report, Paper Developing a Research Proposal.
Format of research proposal, presentation and assessment.

MODULE-IV: PATENTING (10)
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

MODULE-V: PATENT RIGHTS (10)
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

V. TEXT BOOKS:

1. Panneerselvam, Ramasamy. Research methodology. PHI Learning Pvt. Ltd., 2014.
2. Goddard, Wayne, and Stuart Melville. Research methodology: An introduction. Juta and Company Ltd, 2004.
3. Ranjit Kumar, "Research Methodology: A Step-by-Step Guide for beginners". 2nd edition, 2007

VI. REFERENCE BOOKS:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
2. Correa, Carlos M. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed books, 2000.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962

VII. ELECTRONICS RESOURCES:

1. https://wac.colostate.edu/docs/books/try/chapter1.pdf
2. https://www.scribbr.com/dissertation/methodology/
3. http://nptel.ac.in/courses/107108011/

VIII. MATERIALS ONLINE:

1. Course Template
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: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD11	**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:

This course deals with the drawing of various structural elements related to reinforced concrete structures using software package. This will help the students to expose the new software and also minute detailing of the structures. This will also help how to study the existing drawing and incorporate the improvements in the drawings as and when required.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The use of various software tools for drafting of typical structures.
II. The Design and drawings of the structural detailing of the RC elements.
III. The structural drawings of various elements in the structures for preparing quantities.

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
Program for design of slabs using Excel and detailing

Week-II: DESIGN OF CONTINIOUS BEAMS
Program for design of beams using Excel and detailing

Week-III: DETAILING OF CONTINIOUS BEAMS USING CAD
Draw the detailing of continuous beam using CAD

Week-IV: DESIGN OF COLUMN USING EXCEL
Program for design of column using Excel and detailing

Week-V: DESIGN OF FOOTING USING EXCEL
Program for design of footing using Excel and detailing

Week-VI: DETAILING OF FOOTING USING CAD
Draw the detailing of footing using CAD

Week-VII: DESIGN OF STAIRCASE USING EXCEL
Program for design of footing using Excel and detailing

Week-VIII: DETAILING OF STAIRCASE USING CAD
Draw the detailing of staircase using CAD

Week-XI: INTRODUCTION TO DESIGN SOFTWARES
Introduction to analysis and design of software's

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

Week-XI: COMMAND INPUTS
Commands- Using Edit Input-Command Formats-Text Input.

Week-XII: DEVELOPING GEOMETRY AND DIMENSIONING
PRE- Graphical Input Generation-Library- Geometry Generation – Dimensioning

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

Week-XIV: ANALYSIS OF BEAM
Analyze the Beams using Staad Pro.

V. TEXT BOOKS:

1. Terence M. Shumaker, David A., Madsen AutoCAD and its Applications: Advanced AutoCAD, Good heart-Wilcox, 12th edition, 2005

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://dwgmodels.com/construction_details/
3. https://books.google.co.in/books/about/AutoCAD_and_Its_Applications.html?id=BAaznio6H5oC&redir_esc=y

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

ADVANCED CONCRETE LABORATORY								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD12	**Core**	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 course 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 student will try to learn:

I. Design of high-grade concrete and study the parameters affecting its performance.
II. Non-Destructive Testing methods for evaluating the existing structures.
III. The engineering principles to understand behavior of structural elements.

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 CONCRETE
Modulus of rupture.

Week-V: RELATION BETWEEN COMPRESSIVE STRENGTH AND SPLIT 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 Beams 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. TEXT BOOKS:

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. Munford, Paul, and Paul Normand. Mastering Autodesk Inventor 2016 and Autodesk Inventor LT 2016: Autodesk Official Press. John Wiley & Sons, 2015.
2. Dr. M.N. Sesha Praksh and Dr. G.S. Servesh, “Computer Aided Design Laboratory”, Laxmi Publications, 1st edition, 2016.

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

COURSE CONTENT

FINITE ELEMENT METHODS								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD13	**Core**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Advanced Structural Analysis								

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 student will try to learn:

I. The Use of Finite Element Method for structural analysis.
II. The Execution of the Finite Element Program by using Software tools.
III. The continuum problems using finite element analysis.

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 Outline the concepts of elasticity, plane stress and plane strain conditions for the design purpose.

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

CO 4 Explain the concepts of iso-parametric elements for the analysis of Structures.

CO 5 Analyze the plates like slabs using plate elements.

CO 6 Summarize the concepts of non-linear analysis for analyzing the real world situations

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO FEM AND PRINCIPLES OF ELASTICITY (10)
Introduction: Concepts of FEM, steps involved merits and demerits, energy principles, discrimination, raleigh, ritz method of functional approximation. Principles of Elasticity: Stress equations, strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

MODULE-II: 1D AND 2D FEM (10)
One dimensional FEM: Stiffness matrix for beam and bar elements, shape functions foe ID elements. Two-dimensional FEM: Different types of elements for plane stress and plane strain analysis, displacement models, generalized coordinates, shape functions, convergent and compatibility requirements, geometric invariance, natural coordinate system, area and volume coordinates, generation of element stiffness and nodal load matrices.

MODULE-III: DIFFERENT FORMULATIONS AND 3D FEM (09)
Iso-parametric formulation: Concept, different iso-parametric elements for 2D analysis, formulation of 4- Noded and 8-noded isoperimetric quadrilateral elements, Lagrange elements, serendipity elements.

Axi Symmetric Analysis: Bodies of revolution, axi symmetric modeling, strain displacement relationship, formulation of axi symmetric elements. Three-dimensional FEM: Different 3-D elementsstrain, displacement relationship, formulation of hexahedral and isoparametric solid element.

MODULE-IV: ANALYSIS OF PLATES (10)
Introduction to finite element analysis of plates: Basic theory of plate bending, thin plate theory, stress resultants, mindlin's approximations, formulation of 4-noded isoperimetric quadrilateral plate element, shell element.

MODULE-V: NON-LINEAR ANALYSIS (09)
Introduction to nonlinear analysis: basic methods, application to special structures.

V. TEXT BOOKS:

1. Seshu P, “Finite Element Analysis”, Prentice-Hall of India, 1st edition, 2003.
2. Cook R. D, “Concepts and Applications of Finite Element Analysis”, Wiley J., New York, 4th edition, 2001.
3. Krishnamoorthy C.S, "Finite Elements Analysis - Theory and Programming", Tata McGraw Hill publishing company limited, New Delhi, 2nd edition, 2017

VI. REFERENCE BOOKS:

1. Hutton David, “Fundamentals of Finite Element Analysis”, McGraw Hill, 2nd edition, 2017.
2. Buchanan G.R, “Finite Element Analysis, McGraw Hill Publications, New York, 1st edition, 1995.
3. Zienkiewicz O.C. & Taylor R.L, “Finite Element Method”, Vol. I, II & III, Elsevier, 3rd edition, 2000.
4. Belegundu A.D., Chandrupatla, “Finite Element Methods in Engineering”, T.R., Prentice Hall, India, 1st edition, 1991.

VII. ELECTRONICS RESOURCES:

1. http:// nptel.ac.in/courses/105106051/
2. http:// nptel.ac.in/courses/1051050
3. http://web.mit.edu/16.810/www/16.810_L4_CAE.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

STRUCTURAL DYNAMICS								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD14	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Advanced Structural Analysis								

I. COURSE OVERVIEW:

Structural Dynamics is of utmost importance for understanding the analysis and design consideration of structures courseed 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 student 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 courseed 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 of equation of motion of a dynamic system and different loads acting 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 courseed 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 Analyse the two-degree freedom systems courseed to free and forced vibrations for the design purpose.
CO 6 Analyse 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 (10)

Introduction, basic concepts of vibration, dynamic loading, comparison of static loading and dynamic loading, causes of 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 (10)

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 (09)

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 (09)

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 (10)

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. Damodara swamy, "Basics of structural Dynamics and Aseismic Design", PHI Learning Pvt. Ltd., 1st edition, 2012.
2. Clough R. W. and Penzien J, "Dynamics of Structures", 1st edition, McGraw Hill, 1993.
3. Chopra A. K, "Structural Dynamics and Introduction to Earthquake Engineering", illustrated, 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/
2. http://scmero.ulb.ac.be/Teaching/Courses/MECA-H-303/MECA-H-303-Lectures.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

DESIGN OF ADVANCED CONCRETE STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD15	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

Design of reinforced concrete structures is an introductory design course in civil engineering. In this course, basic elements governed by bending, shear, axial forces or combination of them are identified and are considered as building blocks of the whole structure. The design will be done as per IS 456:2000.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The design of special structures by understanding their behavior in terms of shear force and bendingmoment.
II. Design and prepare detail structural drawings for execution citing relevant IS codes.
III. The Design independently civil engineering structures as per the requirements of client and provide detailed design drawings, quality control reports during construction for ensuring quality and economical structures.

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 (10)

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 (10)
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 andlower 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 (09)
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. TEXT BOOKS:

1. Pillai S. U. and Menon D, Reinforced Concrete Design", Tata McGraw-Hill, 3rd edition, 1999.
2. Reinforced concrete design by S. Unnikrishna Pillai & Menon, 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 Loadand 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
2. http://nptel.ac.in/downloads/105105104/

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

DESIGN OF HIGH-RISE STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD16	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
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 Analyze various components involved in design of chimneys

CO 2 Identify about different systems and various loads in tall structures.

CO 3 Identify about various structural systems and their behavior.

CO 4 Interpret static, dynamic and stability analysis of various systems.

CO 5 Classify various Flooring systems and modern progress of tall structures.

CO 6 Develop Application of software in analysis and design.

IV. COURSE CONTENT:

MODULE-I: DESIGN OF TRANSMISSION/ TV TOWER (09)

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 (10)
Foundation design for varied soil strata.

MODULE-III: TALL BUILDINGS (10)
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 (10)
Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.

MODULE-V: APPLICATION (09)
Application of software in analysis and design.

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+3storeyed)", 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 Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

DESIGN OF MASONRY STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD17	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

Masonry structures constitute approximately 85% of the built stock in a developing country such as India; however, a vast majority of this is non-engineered or semi-engineered constructions demonstrating poor performance, particularly under earthquake actions. The current course aims at elucidating theories on mechanical behavior of masonry assemblages under different actions, and introduces students to working stress and limit state approaches to analysis and design of unreinforced, reinforced, confined masonry structures for gravity and lateral loads, including earthquake loads. The course will also briefly address behavior of masonry infill walls and procedures for structural assessment and strengthening of existing masonry structures. Students who undertake this course will have an understanding of behavior of structural masonry under different loads, and be able to estimate capacities and design masonry walls and systems.

II. COURSE OBJECTIVES:

The student will try to learn:

1. Structural analysis of load bearing brick and block masonry.
2. Structural design of walls, columns and beams in unreinforced and reinforced masonry.
3. Application of simple structural models for calculation and design of building parts and detailing

III. COURSE OUTCOMES:

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

CO 1 Describe about masonry construction

CO 2 Assess the strength and stability of masonry walls

CO 3 Identify the various interactions involved in structural elements

CO 4 Describe the effect of curing, ageing and workmanship of a masonry wall

CO 5 Explain the design aspects of reinforced masonry

CO 6 Make use of various model techniques for analyzing the components

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (09)
Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces

MODULE-II: FLEXURAL STRENGTH (10)
Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane Loading. Shear Strength and Ductility of Reinforced Masonry Members.

MODULE-III: INTERACTIONS (10)
Structural Wall, Columns and Pilasters, behavior of axially loaded columns, axial strength of reinforced masonry columns.

Retaining Wall, principal types of retaining walls, lateral pressures on retaining walls, external stability of a retaining wall, Pier and Foundation

MODULE-IV: PRESTRESSED MASONRY (10)
Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

MODULE-V: ELASTIC ANDINELASTIC ANALYSIS (09)
Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra

V. TEXT BOOKS:

1. Narendra Taly, "Design of Reinforced Masonry Structures", ICC, 2nd edition, 2010.
2. Hamid Ahmad A. and Drysdale Robert.G., "Masonry Structures: Behavior and Design", 1994.
3. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, Structures Publications, Pune, 2013.

VI. REFERENCE BOOKS:

1. Toma Evi Miha, Earthquake-resistant Design of Masonry Buildings, Imperial College Press, 1999

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105102088/28
2. http://civil.iisc.ac.in/ksnseminar.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

ELEMENTS OF BRIDGE ENGINEERING								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD18	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

To become a specialized person in bridge designs with different types and simplify the design and enhance the safety of structures. We take pride in collaborating in the creation of safer structures through elegant designs. Bridge Design and Engineering Consulting Corporation is an innovator in Bridge Engineering.

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 Discuss the IRC standard live loads and design the deck slab type bridges.
CO 2 Analyze the box culverts for the given loading and detail the box culverts.
CO 3 Design and detail of T-Beam bridges.
CO 4 Design and check the stability of piers and abutments.
CO 5 Discuss the bridge foundations and prepare the bar bending schedule
CO 6 Analyze the bridge decks and substructures for various conditions

IV. COURSE CONTENT:

MODULE-I: CONCRETE BRIDGES (10)

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 (10)
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 (10)
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 (09)
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. TEXT BOOKS:

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

COURSE CONTENT

ADVANCED STEEL DESIGN								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD19	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Steel Structures Design and Drawing								

I. COURSE OVERVIEW:

This course is recommended for postgraduate students in the structural engineering program who are interested in learning the design of steel structures. This course provides relevant material properties of different types of steel material specifications and design considerations. It covers the behavior and design of structural steel components and helps to gain an educational and comprehensive experience in the design of simple steel structures. It also delivers students with a thorough understanding of the iterative nature of design and the fundamental principles on which the analyses are based. This course is mainly designed to introduce the behavior and design of tension members, compression members, laterally restrained and unrestrained beams, beam-columns and connections design. It deals with two types of connections namely welded and bolted connections. Students are expected to obtain basic knowledge about the design and failure mode of steel structural members after finishing this course.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Design of steel structural components by using different codal procedures.
II. Analysis and design of beam-columns for stability, strength and drift.
III. Design of welded and bolted joint connections for high rise and bridge structures.

III. COURSE OUTCOMES:

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

CO 1 Learn the behavior and design of structural steel components like truss and frame structures
CO 2 Explain an educational and comprehensive experience in the design of simple steel structures
CO 3 Obtain basic knowledge about the design and failure mode of steel structural members after finished this course.
CO 4 Analyze wind loads on buildings and design truss bridges.
CO 5 Analyze and design of tower structures.
CO 6 Analyze and design various welded and bolted connections

IV. COURSE CONTENT:

MODULE-I: SIMPLE CONNECTIONS –RIVETED, BOLTED PINNED AND WELDED CONNECTIONS (10)

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: STRAIN AND STRESS FIELD (10)

Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

MODULE-III: ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS (09)

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 (09)

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. P. Dayaratnam, “Design of Steel Structures”, S. Chand, 2012.
2. Dr. Ramachandra & Vivendra, “Design Steel Structures” Volume – II, Gehlot Scientitic Publishes Journals Department, 2012.
3. S.K. Duggal, “Limit State Design of Steel Structures”, McGraw Hill Education Private Ltd. New Delhi, 1994

VI. REFERENCE BOOKS:

1. Galyord& Gaylord, “Design of Steel Structures”, Tata McGraw Hill, Education, 2012.
2. Indian Standard Code – IS:800 (2007).
3. B.O. Kuzamanovic and N. Willems, “Steel Design for Structural Engineers”, Prentice Hall (1997).
4. Arya &Azmani, “Analysis of Steel Structure”, 1992

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

COURSE CONTENT

ADVANCED DESIGN OF FOUNDATIONS								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD20	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

Foundation engineering is a branch of geotechnical engineering which applies soil mechanics, structural engineering and project serviceability requirements for design and construction of foundations for on shore, offshore, and in-land structures. This course addresses the design of shallow, deep and well foundations, the stability of slopes, stability of retaining walls and embankments against failure. The course also discusses the safety and serviceability considerations in the design of foundations.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The methods of soil exploration, field tests on soil by planning and soil investigation report documentation.
II. The stability of infinite and finite slopes using different parameters.
III. The various earth pressure theories and stability of retaining walls.
IV. The lab experiments and field tests for the estimation of bearing capacity of shallow, deep and well, foundations.

III. COURSE OUTCOMES:

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

CO 1 Discover standardized method of soil exploration for classifying the soil core type and to make decision on type and depth of foundation.
CO 2 Evaluate the bearing capacity of the foundation soil for selecting the suitable type and depth foundation and to make surface from the settlement.
CO 3 Inspect the pile group capacity and settlement of the foundation soil under the action of eternal load for selecting the accurate type of the pile foundation.
CO 4 Examine the theories and recommended provisions to avoid underground structures free from the collapse and tilting.
CO 5 Select most accurate type and method for laying the sheeting and bracing related to shallow and deep cuts to make sure the structures safe from the uplift pressure.
CO 6 Discover the soil-structure interaction under the shock load and vibration loads to ensure structures free from the failures due to the action of sudden and earthquake loads.

IV. COURSE CONTENT:

MODULE-I: PLANNING OF SOIL EXPLORATION (09)
Planning of soil exploration for different projects, methods of subsurface exploration, methods of Borings along with various penetration tests.

MODULE-II: SHALLOW FOUNDATIONS (10)
Requirements for satisfactory performance of foundations, methods of estimating bearing capacity, settlements of footings and rafts, proportioning of foundations using field test data, pressure - settlement characteristics from constitutive laws.

MODULE-III: PILE FOUNDATIONS (10)
Methods of estimating load transfer of piles, settlements of pile foundations, pile group capacity and settlement.

Laterally loaded piles, pile load tests, analytical estimation of load- settlement behavior of piles, proportioning of pile foundations, lateral and uplift capacity of piles.

MODULE-IV: WELL FOUNDATION (09)
IS and IRC code provisions, elastic theory and ultimate resistance methods. Tunnels and arching in soils, pressure computations around tunnels.

MODULE-V: OPEN CUTS, COFFER DAMS (10)
Sheeting and bracing systems in shallow and deep open cuts in different soil types.
Coffer dams, various types, analysis and design, foundations under uplifting loads, soil-structure Interaction

V. TEXT BOOKS:

1. Kurian, Nainan P., and Nainan P. Kurian. "Design of foundation systems: principles and practices". Alpha Science Int'l Ltd., 2005.
2. J. E. Bowles, "Foundation Analysis and Design", Tata McGraw Hill New York, 1988.

VI. REFERENCE BOOKS:

1. Analysis and Design of Substructures, Swami Saran, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi, 2002

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105105039/
2. https://lecturenotes.in/course/244/advanced-foundation-engineering-afe

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

DESIGN OF INDUSTRIAL STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD21	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

The purpose of this course is to develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard. On completion of this course student gain good confidence in designing major industrial structures like bridge plate girders, industrial structures like gantry girders, water tanks, support structures, high rise chimneys and pre-engineered thin walled structures.

II. COURSE OBJECTIVES:

The student will try to learn:

I. Design principles of Steel Gantry Girders, bunkers and silos.
II. The design and detailing of portal frames and gable frames
III. The design of, resting on the ground and elevated water tanks according to IS code.

III. COURSE OUTCOMES:

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

CO 1 Discuss the planning and functional requirements of Industrial structures.
CO 2 Discover the need to learn about the design concepts, and constructional aspects of Industrial structures
CO 3 Analyze and evaluate the importance of various construction materials for Industrial constructions
CO 4 Design portal frames, tower cranes and bracing system in Industrial buildings.
CO 5 Analyze and design various structural elements in water tanks
CO 6 Analyze and design structural elements used in pre-cast construction including fabrication, erection and installation

IV. COURSE CONTENT:

MODULE-I: STEEL GANTRY GIRDERS (10)

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.

MODULE-II: PORTAL FRAMES (09)

Design of portal frame with hinge base, design of portal frame with fixed base -Gable Structures – Lightweight Structures

MODULE-III: PILE FOUNDATIONS (10)
Design of square bunker, Jansen's and Airy's theories, IS Code provisions – Design of side plates.

Stiffeners, Hooper, Longitudinal beams Design of cylindrical silo, Side plates, ring girder, stiffeners.

MODULE-IV: CHIMNEYS (09)
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

MODULE-V: WATER TANKS, DESIGN OF PRESSED STEEL WATER TANK (10)
Design of stays: Joints, Design of hemispherical bottom water tank, side plates, Bottom plates, joints, Ring girder: Design of staging and foundation.

V. TEXT BOOKS:

1. Punmia B. C., Jain Ashok Kr., Jain Arun Kr, "Design of Steel Structure", Lakshmi Publishers, 2nd edition,1998.

VI. REFERENCE BOOKS:

1. Ram Chandra, "Design of Steel Structures', Standard Publishers, 12th edition, 2009.
2. Subramaniyam., "Design of Steel Structures", Oxford University Press, 2016.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105106113/3
2. http://nptel.ac.in/downloads/105106113/

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

REHABILITATION AND RETROFITTING OF STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD22	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Building Materials – Planning and Construction, Concrete Technology								

I. COURSE OVERVIEW:

The primary objective of this course is to introduce the concept of Rehabilitation as a precise concept, and study how to overcome the defects in regular construction practices, establish their effectiveness in overcoming the problems faced, study their efficiency and memory needs. The course consists of Retrofitting components in addition to adapting new techniques in construction practices. Retrofitting reduces the vulnerability of damage of an existing structure during a future earthquake. It aims to strengthen a structure to satisfy the requirements of the current codes for seismic design. In this respect, seismic retrofit is beyond conventional repair or even rehabilitation. The applications include different types of buildings, industrial structures, bridges, urban transport structures, marine structures and earth retaining structures. The benefits of retrofitting include the reduction in the loss of lives and damage of the essential facilities, and functional continuity of the life line structures.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The concepts of defects, distress and deterioration of structures, and the need of rehabilitation and retrofitting methods.
II. The importance of maintenance, repairs and rehabilitation of structures like residential, industrial and irrigation structures.
III. The mechanism of corrosion and surface deterioration of various materials in traditional structures.
IV. The Modern techniques of strengthening and demolition of engineering structures in real time situations.

III. COURSE OUTCOMES:

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

CO 1 Explain the damage mechanism and preventive measures for protecting the structure from damages.
CO 2 Interpret the importance and facets of maintenance for scheduling regular inspection of residential and industrial structures.
CO 3 Summarize corrosion protection methods of steel and deterioration of materials for protecting structures from rusting and fatigue failures.
CO 4 Identify the materials and technics of repair for rehabilitation and retrofitting of structures.

CO 5 Make use of non-destructive testing procedures, demolition methods for assessing and improving the performance of structures.

CO 6 Select suitable engineered and non-engineered techniques in existing structures for strengthening and demolition.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (09)

Deterioration of structures; distress in structures; causes and prevention, mechanism of damage; types of damage; damage under accidental and cyclic loads, cracking in structures, evaluation of damage

MODULE-II: MAINTENANCE AND DIAGNOSIS OF FAILURE (10)

Maintenance, repair and rehabilitation, facets of maintenance, importance of maintenance, various aspects of inspection; Assessment procedure for evaluating a damaged structure; Diagnosis of construction failures.

MODULE-III: DAMAGES AND THEIR REMEDIES (10)

Corrosion damage of reinforced concrete, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, cathodic protection, rust eliminators.

Causes of deterioration of concrete, steel, masonry and timber structures, surface deterioration, efflorescence, causes and preventive measures; coatings for embedded steel and set concrete.

MODULE-IV: MATERIALS AND TECHNIQUES OF REPAIR (10)

Special concrete and mortar, concrete chemicals, expansive cement, polymer concrete sulphur infiltrated concrete, ferro cement, fiber reinforced concrete, methods of repair in concrete, steel, masonry and timber structures. Gunite and shotcrete, epoxy injection.

MODULE-V: STRENGTHENING AND DEMOLITION ASPECT (09)

Strengthening of existing structures; repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure, use of non-destructive testing techniques for evaluation, load testing of structure; demolition of structures using engineered and non-engineered techniques; case studies.

V. TEXT BOOKS:

1. P. H. Emmons, G. M. Sabnis, “Concrete repair & maintenance illustrated,” Galgotia Publications Pvt. Ltd., 2001.
2. P. C. Varghese, “Maintenance, repair, rehabilitation and minor works of buildings,” Prentice Hall India Learning Private Limited, 2014.
3. Shetty .M.S., "Concrete, Technology", Theory and Practice, S. Chand and Company, New Delhi 2010
4. Allen .R.T. and Edwards .S.C., "Repair of Concrete Structures" Blakie and Sons, UK 1987.

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.
3. Bungley, Surrey “Non-destructive evaluation of concrete structures,” University Press.
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. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

STRUCTURAL DESIGN LABORATORY								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD23	**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: Advanced Structural Design Laboratory								

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

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 COLOMUNS
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. TEXT BOOKS:

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. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

NUMERICAL ANALYSIS LABORATORY								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD24	**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 deals with the numerical solutions of linear and non-linear equations by using different algorithms. These includes bi section method, newton's method, method of least squares, gauss elimination method, gauss zordan method, gauss seidal method, trapezoidal rule, Simpson's rule and ranga-kutta method. This will enable the students to accostum with programming using different computer languages.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Roots of non-linear equations by Bisection method and Newton's method.
II. The system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/Gauss - Jorden Method.
III. The integrations numerically using Trapezoidal and Simpson's rules

III. COURSE OUTCOMES:

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

CO 1 Analyze the roots of non-linear equation using bisection and newton's method.

CO 2 Evaluate the curve fitting by using method of least squares approximations.

CO 3 Determine the linear system of equations using Gauss elimination, Gauss Seidal and gauss Jordan methods.

CO 4 Solve the integrations numerically using trapezoidal and Simpson's rule.

CO 5 Explain the numerical solution of ordinary differential equations using Euler's Method.

CO 6 Analyze the numerical solution of ordinary differential equations by using Runge-Kutta Method.

IV. COURSE CONTENT:

Week-I: BISECTION METHOD
Find the Roots of Non-Linear Equation Using Bisection Method

Week-II: NEWTON'S METHOD
Find the Roots of Non-Linear Equation Using Newton's Method.

Week-III: CURVE FITTING
Curve Fitting by Least Square Approximations.

Week-IV: GAUSS ELIMINATION METHOD
Solve the System of Linear Equations Using Gauss - Elimination Method.

Week-V: GAUSS SEIDAL ITERATION METHOD
Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.

Week-VI: GAUSS JORDEN METHOD
Solve the System of Linear Equations Using Gauss - Jorden Method

Week-VII: TRAPEZIODIAL RULE
Integrate numerically using Trapezoidal Rule.

Week-VIII: SIMPSON'S RULE
Integrate numerically using Simpson's Rules.

Week-IX: EULER'S METHOD
Numerical Solution of Ordinary Differential Equations by Euler's Method.

Week-X: RUNGE KUTTA METHOD
Numerical Solution of Ordinary Differential Equations by Runge- Kutta Method.

Week-XI: NEWTON – RAPHSON METHOD
Numerical Solution of Ordinary Differential Equations Newton – Raphson Method

Week-XII: SECANT METHOD
Numerical Solution of Ordinary Differential Equations secant method

Week-XIII: BRENT'S METHOD
Numerical Solution of Ordinary Differential Equations Brent's method

Week-XIV: MULLER'S METHOD
Numerical Solution of Ordinary Differential Equations Muller's method

V. TEXT BOOKS:

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. http://www.iitg.ac.in/physics/fac/charu/courses/ph508/lab5.pdf
2. https://www.researchgate.net/publication/275014975_A_Numerical_Analysis_Lab_Solving_System_of_Linear_Equations

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

MINI PROJECT WITH SEMINAR								
II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD25	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	40	60	100
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: 36**				**Total Classes: 36**		
Prerequisite: NIL								

I. COURSE OBJECTIVES:

The student will try to learn:

I. How to identify various engineering problems and reviewing available literature.
II. The different techniques used to analyze the complex structural systems.
III. Work on the solutions given and present solution by using his/her technique applying engineering principles.

GUIDELINES TO BE FOLLOWED

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the Departmental committee.

COURSE CONTENT

DESIGN OF PRESTRESSED CONCRETE STRUCTURES								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD26	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

Introduction to prestressed concrete-prestressing concepts; pre-tensioning and post-tensioning; full and partial prestress; the need for prestress; advantages and disadvantages; methods of prestressing. Forces imposed by prestressing (straight, draped and kinked tendon profiles). Load balancing. Introductory examples. Design requirements: strength and serviceability. Material properties. Design for serviceability: stress limits; serviceability criteria; determination of prestress and eccentricity; cable profiles; cracked section analysis; decompression and cracking moment; effect of cracking at service loads; short-term deflection calculations; crack control; design for strength: limit state design. Rectangular stress block. Ultimate moment capacity.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The concepts of prestressed concrete structures and the behaviour of these structures courseed to loads for the design purpose.
II. The design of structural elements necessary for creating efficient and economic prestressed concrete structures.
III. The 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 Analyse prestressed concrete structural elements courseed to flexure for the design purpose.
CO 4 Design prestressed concrete structural elements courseed 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 utilisation of prestressing force
CO 6 Design the composite prestressed concrete structural elements courseed to flexure and shear for designing multi storied structures

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO PRESTRESSED CONCRETE (10)

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 PRESTRESS (09)

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 IN PSC (10)

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 (09)

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: ACOMPOSITE BEAMS AND DEFLECTIONS (10)

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, introduction to pre-fabrication technology.

V. TEXT BOOKS:

1. Krishnaraju N, "Prestressed Concrete", Tata McGraw Hill, New Delhi, 6th edition, 2018.
2. Lin T.Y, "Design of Prestressed Concrete Structures", Asia Publishing House, 1st edition, 1955.

VI. REFERENCE BOOKS:

1. GuyanY, "Limited State Design of Prestressed Concrete", Applied Science Publishers, 1972.
2. IS: 1343- Code of Practice for Prestressed Concrete.
3. IRC: 112- code for concrete road bridges

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105106117/
2. http://textofvideo.nptel.ac.in/105106118/lec17.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

ANALYSIS OF LAMINATED COMPOSITE PLATES								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD27	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Theory of Plates and Shells								

I. COURSE OVERVIEW:

Laminated composite materials are increasingly being used in a large variety of structures including aerospace, marine and civil infrastructure owing to the many advantages they offer: high strength/stiffness for lower weight, superior fatigue response characteristics, facility to vary fiber orientation, material and stacking pattern, resistance to electro-chemical corrosion, and other superior material properties of composites.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The analysis of rectangular composite plates using different analytical methods.
II. The Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT
III. The development of computer programs for the analysis of composite plates.

III. COURSE OUTCOMES:

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

CO 1 Apprehend the stress strain relationship of orthotropic and anisotropic materials.

CO 2 Assess the failure criterion and fracture mechanics of composites.

CO 3 Analyze the rectangular composite plates using the analytical methods.

CO 4 Analyze the composite plates using advanced finite element method

CO 5 Develop the computer programs for the analysis of composite plates

CO 6 Analyze the rectangular laminated plates using finite element methods

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Displacement Field Approximations for Classical Laminated Plate Theory (CLPT)and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT.

MODULE-II: GOVERNING EQUATIONS (10)

Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

MODULE-III: FINITE ELEMENT SOLUTIONS (09)
Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT.

Stiffness Matrix and Truss element, truss element stiffness matrix, truss element bending function and Beam element

MODULE-IV: INTRODUCTION TO FINITE ELEMENT METHOD (09)
Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses

MODULE-V: FEM MODELLING OF LAMINATED PLATES (10)
Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT. Finite Element Model, Element Formulation, Post Computation of Stresses.
Analysis of Rectangular Composite Plates using Analytical Methods.

V. TEXT BOOKS:

1. J. N. Reddy, "Mechanics of Laminated Composite Plates and Shells", 1997.
2. Ye, Jianqiao. "Laminated Composite Plates and Shells: 3D Modeling". Springer Science & Business Media, 2002.

VI. REFERENCE BOOKS:

1. Reddy J. N., CRC Press, "Mechanics of Laminated Composites Plates and Shells", 1997.

VII. ELECTRONICS RESOURCES:

1. http://ethesis.nitrkl.ac.in/5685/1/110ME0327-3.pdf
2. http://ethesis.nitrkl.ac.in/5878/1/110ME0335-6.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

FRACTURE MECHANICS OF CONCRETE STRUCTURES								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD28	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Theory of Elasticity and Plasticity								

I. COURSE OVERVIEW:

Over the last twenty years, many theoretical, numerical and experimental methods have evolved in the field of Fracture Mechanics of Concrete. These have led to practical applications in reinforced-concrete design, assessment, monitoring and retrofitting, as well as innovative high-performance and durable cementations materials. Although Fracture Mechanics of Concrete is now mature as a framework for defining and solving a variety of engineering problems, there is still much work to be done in improving previous theoretical and numerical models, and for re-interpreting established phenomena. In particular, there are new developments in the treatment of scale effects; the implementation of 3D-discretisation; and the combination of continuous and discontinuous models. Other areas of rapid progress are the development of innovative testing techniques; the proposal of non-local and anisotropic constitutive laws; the formulation of lattice and multistage models, and the development of coupled multifold theories.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The concepts and principles of fracture mechanics for the analysis of structural components.
II. The analytical and computational tools needed to solve the idealized problems.
III. The fracture and fatigue behavior of different materials to focus on research in this area.

III. COURSE OUTCOMES:

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

CO 1 Describe the fracture types and micro mechanism for concrete structures

CO 2 Explain the energy concepts in crack and crack resistance for the analysis of structural components.

CO 3 Demonstrate the linear elastic fracture mechanics for the propagation of cracks.

CO 4 Interpret the importance of Crack tip plastic zone for durable concrete structures.

CO 5 Explain micromechanics and various models in crack for fracture mechanics models.

CO 6 Describe the crack propagation concepts for the applications of concrete structures.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (09)

Fracture mechanics, crack in a structure, mechanisms of fracture and crack growth, cleavage fracture

MODULE-II: CRACKING MECHANISM (09)
Ductile fracture, fatigue cracking, environment assisted cracking, service failure analysis

MODULE-III: STRESS AT CRACK TIP (10)
Stress at crack tip, linear elastic fracture mechanics, Griffith's criteria, stress intensity factors.

Crack tip plastic zone, Erwin's plastic zone correction, R curves, compliance, J integral, concept of CTOD and CMD.

MODULE-IV: MATERIAL MODELS (10)
General concepts, crack models, band models, models based on continuum damage mechanics

MODULE-V: APPLICATIONS TO CONCRETE STRUCTURES (10)
Applications to High Strength Concrete, Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling

V. TEXT BOOKS:

1. Suri C. T. and Jin Z.H., "Fracture Mechanics", Elsevier Academic Press, 1st Edition, 2012.
2. Broek David, "Elementary Engineering Fracture Mechanics", Springer, 3rd Rev, 1982.
3. Elfgreen L, "Fracture Mechanics of Concrete Structures – Theory and Applications", RILEM Report, Chapman and Hall, 1989.

VI. REFERENCE BOOKS:

1. Victor, Li C., Bazant Z. P, "Fracture Mechanics – Applications to Concrete", ACI SP 118, ACI Detroit, 1989.

VII. ELECTRONICS RESOURCES:

1. http://www.nptel.ac.in/courses/112106065/#
2. http://www.civil.northwestern.edu/people/bazant/PDFs/Papers/P90.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD29	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Structural Dynamics								

I. COURSE OVERVIEW:

This course aims to broaden the intellectual capacity of students in understanding the natural causes of earthquakes and their consequences on the built environment; to introduce them to the basic principles of dynamic structural behavior and seismic design procedures. The course deals with causes of earthquakes, characteristics of earthquake ground motions, earthquake magnitude and intensity measurements. Seismic response analysis of simple structures. Derivation of elastic response spectra and earthquake design spectra. Earthquake design criteria. Free and forced vibration analysis of frame structures. Modal spectral analysis and equivalent static lateral force method. Design codes, design applications.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The causes of earthquake and potential consequences of strong earthquakes on structures and civil infrastructure.
II. Design, construct and maintain structures to perform at earthquake exposure up to the expectations and in compliance with building codes
III. Single degree of freedom systems courseed to free and forced vibrations

III. COURSE OUTCOMES:

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

CO 1 Summarize engineering seismology and discuss the causes and effects of earthquakes by using seismic design parameters.
CO 2 Interpret the requirements of building codes of practice on seismic detailing of reinforced concrete building structures.
CO 3 Explain the seismic analysis and design lateral loads for the modeling of RCC structures.
CO 4 Analyze in detail the multi-storeyed structures using I.S Codes by seismic coefficient and response spectrum methods.
CO 5 Design multi-storey building and shear walls using I.S:13920 code.
CO 6 Design earthquake-resistant masonry buildings by using lateral load analysis.

IV. COURSE CONTENT:

MODULE-I: EARTHQUAKE GROUND MOTION AND STRUCTURAL DYNAMICS (10)
Engineering seismology, seismic zoning map of India, strong motion studies in India, strong motion Characteristics, evaluation of seismic design parameters. Initiation into structural dynamics, dynamics of SDOF systems, theory of seismic pickup, numerical evaluation of dynamic response, response spectra, dynamics of MDOF systems.

MODULE-II: CONCEPTS OF EARTHQUAKE RESISTANT DESIGN OF RCC STRUCTURES (10)
Basic elements of earthquake resistant design, identification of seismic damages in RCC buildings, effect of structural irregularities on performance of RCC buildings during earthquakes, earthquake resistant building architecture.

MODULE-III: SEISMIC ANALYSIS AND MODELING OF RCC STRUCTURES (10)
Code based procedure for determination of design lateral loads, infill walls, seismic analysis procedure as per IS 1893 code.

Equivalent static force method, response spectrum method, time history analysis, mathematical modeling of multi-storey RCC buildings.

MODULE-IV: EARTHQUAKE RESISTANT DESIGN OF RCC STRUCTURES (09)
Ductility considerations, earthquake resistant design of multi-storey RCC buildings and shear walls based on IS 13920 code, capacity based design

MODULE-V: EARTHQUAKE RESISTANT DESIGN OF MASONRY STRUCTURES (10)
Identification of damages and non-damages in masonry buildings, elastic properties of structural masonry, lateral load analysis of masonry buildings, seismic analysis and design of one-storey and two-storey masonry buildings.

V. TEXT BOOKS:

1. S. K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, 2009.
2. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd, 2001.
3. T. Paulay and M.J.N. Priestly, "Seismic Design of Reinforced Concrete and Masonry Building", John Wiley & Sons, 2009.

VI. REFERENCE BOOKS:

1. Anil K. Chopra, "Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice-Hall India Pvt Ltd, 2nd Edition, 2001.
2. Anand S.Arya, Nemchand & Bros, "Masonry and Timber Structures including Earthquake Resistant Design, 1995.
3. MihaTomazevic, "Earthquake Resistant Design of Masonry Building, Imperial college Press, 1992.
4. C.V.R. Murty, "Earthquake tips – Learning Earthquake Design and Construction, 2004.

VII. ELECTRONICS RESOURCES:

1. http://www.nicee.org/iaee/E_Chapter3.pdf
2. http://www.iitk.ac.in/nicee/wcee/article/vol.3_session4_1917.pdf
3. https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/BSSC/FEMA_P-749.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

COST MANAGEMENT OF ENGINEERING PROJECTS								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD30	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

The Cost Management of Engineering Project offers a comprehensive and systematic introduction to the basic principles and basic approach of the project cost management as well as the application in engineering practice. The main content includes the outline of project cost management, project cost forecasts, project cost plan, project cost control, cost accounting, cost analysis, project cost assessment, responsibility cost management, financing cost management, procurement cost management and quality cost management. Scope, time, and cost management are at the heart of successful project management. This course will give you the tools to develop a project scope, schedule and budget and then status them to predict project performance.

II. COURSE OBJECTIVES:

The student will try to learn:

I. Establish systems to help streamline the transactions between corporate support departments and the operating units.
II. Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units.
III. Use pseudo profit centers to create profit maximizing behavior in what were formerly cost centers.

III. COURSE OUTCOMES:

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

CO 1 Build the strategic cost management plans to ensure that the completion of the project with in the proposed budget.
CO 2 Simplify the complex problems related financial matters using appropriate cost management system for effectively utilizing available funds and timely completion of project as well.
CO 3 Categorize the proposed project into different levels considering various work phases, technical and non-technical activates for smoothly organizing the project.
CO 4 Plan the execution of the project constructing network diagrams for timely arranging the funds, material, and work force as well.
CO 5 Examine the complex problems related cost aspects during the different phases of construction and notify the variances from the original cost to fix the targets, arrange the funds and material as well.
CO 6 Compare different cost management techniques and notify the problems that might be take place during the project execution for taking appropriate decision towards smoothly and timely completion of the given project.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (09)
Introduction and Overview of the Strategic Cost Management Process

MODULE-II: COST CONCEPTS (10)
Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

MODULE-III: PROJECT MANAGEMENT (10)
Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical 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-IV: COST BEHAVIOR AND PROFIT PLANNING (10)
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. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

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

V. TEXT BOOKS:

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

VI. REFERENCE BOOKS:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster, Advanced Management Accounting.

VII. ELECTRONICS RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc16_ce02/preview
2. http://nptel.ac.in/downloads/110101003/

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank

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

COURSE CONTENT

WASTE TO ENERGY								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD31	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

The course is designed to create environmental awareness and consciousness among the present generation to become environmental responsible citizens. The course will discuss on the municipal solid waste composition, characteristics and to improve the methods to minimize municipal solid waste generation. This course deals with methods of disposal of solid waste by thermal biochemical processes and production of energy from different types of waste sand to know the environmental impacts of all types of municipal waste.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The principles of solid waste management in reducing and eliminating dangerous impacts of waste materials on human health and the environment to contribute economic development and superior quality of life.
II. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.
III. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.

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	Illustrate the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.
CO 3	Understand the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.
CO 4	Outline the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.
CO 5	Apply the knowledge in planning and operations of waste to Energy plants by following legal legislation related to solid waste management.
CO 6	Illustrate the thermo-chemical conversion of Biogas by using Gasification process for energy generation.

IV. COURSE CONTENT:

MODULE –I: WASTE SOURCES & CHARACTERIZATION (10)

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 (10)

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: WASTE TO ENERGY & ENVIRONMENTAL IMPLICATIONS (09)

Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on non-renewable fuel resources.

Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms.

MODULE –IV: THERMO-CHEMICAL CONVERSION (10)

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 (09)

Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – 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. TEXT BOOKS:

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 (Ed), "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.
5. M Datta, "Waste Disposal in Engineered Landfills", Narosa Publishing House, 1997

VII. ELECTRONICS RESOURCES:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 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. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

INDUSTRIAL SAFETY								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD32	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In this course, students develop a comprehensive understanding of industrial safety principles and practices. They are equipped with the skills to identify, assess, and manage workplace hazards, promoting a culture of safety in their future engineering careers. Emphasis is placed on industrial safety and OSHA regulations. Upon completion, students should be able to demonstrate knowledge of a safe working environment and OSHA compliance

II. COURSE OBJECTIVES:

The student will try to learn:

I. Inherent safety principles in managing risks.
II. Prioritizing interventions based on the inherent hazards of the site and/or pipeline, performance of duty holders in controlling risks and other defined operational intelligence.
III. The immediate causes of any deficiencies in duty holders arrangements for managing risks.

III. COURSE OUTCOMES:

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

CO 1	Provide information regarding different elements of industrial water pollution and Methods of treatment.
CO 2	Expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.
CO 3	Know how to take safety measures in executing works
CO 4	Identify the need for maintenance (or) replacement of equipment
CO 5	Understand the need for periodic and preventive maintenance.
CO 6	Estimate the various types of loads such as Dead, Live and Wind loads on PEB’s

IV. COURSE CONTENT:

MODULE –I: INDUSTRIAL SAFETY (10)

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 (10)
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 (10)
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: FAULT TRACING (09)
Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like Any one machine tool, pump, air compressor.

MODULE –V: PERIODIC AND PREVENTIVE MAINTENANCE (09)
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. TEXT BOOKS:

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. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

VII. ELECTRONICS RESOURCES:

1. https://youtu.be/v-eltsixu4I
2. https://hsseworld.com/wp-content/uploads/2020/08/Industrial-Safety-Management.pdf
3. https://nibmehub.com/opacservice/pdf/read/Industrial%20Safety%20and%20Health%20Management.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

ENERGY EFFICIENT BUILDINGS								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD33	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

The course provides knowledge regarding building physics, ventilation technology and indoor climate, etc. that provide a better understanding of building-related problems of various kinds, in order to apply technologies that will contribute to both energy efficient and healthy buildings. Energy efficient buildings are a cornerstone of a prosperous, sustainable and healthy society. This course aims to prepare participants to successfully advance energy efficient building construction and retrofits.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The concept of reduction in energy consumption through low energy building design.
II. Strategies to integrate daylighting and low energy heating/cooling in buildings.
III. Illumination requirements artificial lighting and factors affecting day lighting.

III. COURSE OUTCOMES:

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

CO 1	Understand the concept of reduction in energy consumption through low energy building design.
CO 2	Examine strategies to integrate day lighting and low energy heating / cooling in buildings.
CO 3	Demonstrate a good ability to calculate the energy balance of buildings without the help of available energy calculation programs.
CO 4	Assess whether there is a potential conflict between energy conservation and indoor climate for different energy saving measures.
CO 5	Analyze and interpret results both critically and independently regarding energy and indoor climate in buildings.
CO 6	Demonstrate a good ability to work independently on investigating energy and indoor climate issues for buildings and to present the results both orally and in writing in well-prepared technical reports.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO ENERGY EFFICIENCY IN BUILDINGS (10)

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 (10)
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

MODULE-V: CASE STUDIES (10)
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. ISBN: 9780135312032.
2. Ian M. Shapiro (2016), Energy Audits and Improvements for Commercial Buildings, John Wiley & Sons.
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 Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation

COURSE CONTENT

ENGLISH FOR RESEARCH PAPER WRITING								
III Semester: AE, CSE, ES, EPS, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSD02	**Audit**	-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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. SYLLABUS:

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, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSD03	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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. SYLLABUS

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**
BHSD04	**Audit**	-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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. SYLLUBUS:

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, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSD05	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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. SYLLABUS:

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, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSD06	**Audit**	-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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 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. SYLLABUS:

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

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, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSD07	**Audit**	-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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 teachers 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. SYLLABUS:

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, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSD08	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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 yog and its impartance

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. SYLLABUS:

MODULE – I: INTRODUCTION

Definitions of Eight parts of yog. (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								
III Semester: AE, CSE, ES, EPS, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSD09	**Audit**	-	-	-	-	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**	**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. SYLLUBUS:

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 2023-2024 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 75% 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 MT23 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