INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)

Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY
STRUCTURAL ENGINEERING

ACADEMIC REGULATIONS, COURSE CATALOG AND SYLLABI
PG21

M.Tech Regular Two Year Degree Program

(for the batches admitted from the academic year 2021 - 2022)

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.

M.TECH (STRUCTURAL ENGINEERING) - PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

The students of M.Tech Structural Engineering are prepared to:

PEO - I	Develop the skills for development of new materials, design and construction of structures that are sustainable.
PEO - II	Expose the students to the latest innovations and trends with a view to inculcate research orientation in structural engineering as well as in multidisciplinary streams..
PEO - III	Adopt to the technological advancements for professional development to cater for the changing needs of the society through critical thinking.
PEO - IV	Become as Professional Engineers, teaching experts and engage in Research and Development works both with ethically and societal responsibility.

M.TECH - PROGRAM OUTCOMES (PO's)

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

PO - 1	An ability to Independently carry out research/investigation and development work to sol 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 t 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.

CONTENTS

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

PRELIMINARY DEFINITIONS AND NOMENCLATURES

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

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

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

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

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

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

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

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 subject offered by the University 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 Structural Engineering, Embedded Systems, CSE, 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 / UG degree program: B.Tech.

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, subject 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 "PG21" 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.

FOREWORD

The autonomy is conferred to Institute of Aeronautical Engineering (IARE), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

IARE is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2021 - 22)

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.

1.0 CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice 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.

2.0 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.

3.0 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.

4.0 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

5.0 TYPES OF COURSES

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

5.1 Core Course:

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 Course:

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 Course:

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 Audit Course:

The value added courses are audit courses offered through joint ventures with various organizations providing ample Scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen fields of study. A plenty of value added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

6.0 SEMESTER STRUCTURE

The Institute shall follow semester pattern. An academic year shall consist of two semesters. Each semester shall be of 23 weeks' duration and this period includes time for course work, examination preparation and conduct of examinations. Each main semester shall have a minimum of 90 working days. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic calendar shall be declared at the beginning of the academic year as shown in Table 2.

Table 2: Academic Calendar

<table>
<tr><td rowspan="6">FIRST SEMESTER (23 weeks)</td><td>I Spell Instruction Period</td><td>9 weeks</td><td rowspan="5">21 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td>Preparation and Practical Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="3">Semester Break and Supplementary Exams</td><td>2 weeks</td></tr>
<tr><td rowspan="6">SECOND SEMESTER (23 weeks)</td><td>I Spell Instruction Period</td><td>9 weeks</td><td rowspan="5">21 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 Week</td></tr>
<tr><td>Preparation & Practical Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="3">Summer Vacation and Supplementary Exams</td><td>4 weeks</td></tr>
<tr><td rowspan="6">THIRD SEMESTER</td><td>I Spell Instruction Period</td><td>9 weeks</td><td rowspan="5">19 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td colspan="2">Project Work Phase - I</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>1 week</td></tr>
<tr><td>FOURTH SEMESTER</td><td colspan="2">Project Work Phase - II</td><td>18 Weeks</td></tr>
</table>

7.0 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 CGPA $\geq$ 6.0, and shall pass all the mandatory Audit Courses to complete the M.Tech program successfully.

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.

8.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core Courses, Professional core elective courses, Audit courses, Open elective courses, Laboratory courses, Mini project with seminar, Project work-1 and Project work-2.

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.
- **Project Work:** 1 credit for 2 hours of project work per week.

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 Core 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	Project Work-1 Dissertation	20	10
8	Project Work-2 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
Project Work-1	1 @10credit	10
Project Work-2	1 @16credits	16
TOTAL CREDITS		**68**

9.0 EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE).

9.1.1 Semester End Examination (SEE):

The SEE shall be conducted for 70 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE units and each unit 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 14 marks. There could be a maximum of 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 30 marks, with 20 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 / 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: Assessment pattern for Theory Courses

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (End-term)	10	
	Assignment	5	
	Alternative Assessment Tool (AAT)	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			**100**

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th 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. One assignment has to submit at the end of the CIE2 for the questions provided by the 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.

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 includes, concept videos, course related term paper, technical seminar, term paper, paper presentations conducted by reputed organizations relevant to the course etc.**

9.2 Laboratory Course:

Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks each in a semester.

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.

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 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, 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 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	Guide	30
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, guide and HOD.	70
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 guide wherein the HOD convenes its meeting.	30
4		End Semester Examination (An open seminar followed by viva- voce)	The External Evaluation Committee (EEC) comprising of External Examiner, HOD and guide wherein the HOD shall be the chairman of the committee.	70
Total (Phase-II)				**100**

9.3.4 As soon as a student submits his 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.

10.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

10.1 It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 75% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

10.2 For cases of medical issues, deficiency of attendance in each course to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 75% to 65% in every course, subjected to submission of medical certificate and other needful documents to the concerned department.

10.3 The basis for the calculation of the attendance shall be the period prescribed by the institute by its calendar of events. For late admission, attendance is reckoned from the date of admission to the program.

10.4 However, in case of a student having less than 65% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

10.5 Students whose shortage of attendance is not condoned in any subject are not eligible to write their semester end examination of that courses and their registration shall stand cancelled.

10.6 A prescribed fee shall be payable towards Condonation of shortage of attendance.

10.7 A candidate shall put in a minimum required attendance at least in three (3) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

10.8 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, s/he shall not be eligible for readmission into the same class.

11.0 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 Question papers may be moderated for the coverage of syllabus, pattern of questions by Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations.

11.3 Internal Examiner shall prepare a detailed scheme of valuation.

11.4 The answer papers of semester end examination should be evaluated by the internal examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

11.5 In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and marks awarded by him shall be taken as final.

11.6 HOD shall invite 3-9 external examiners to evaluate all the end semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

11.7 Examination Control Committee shall consolidate the marks awarded by internal and external examiners to award grades.

12.0 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 for each theory course in the semester end examination, and
ii. A minimum of 50% 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 / Seminar / Project, if s/he secures

i. Not less than 40% marks for each Laboratory / Seminar / Project course in the semester end examination,
ii. A minimum of 50% marks for each Laboratory / Mini project with Seminar / Project course considering both internal and semester end examination.

12.3 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 10point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
90% and above (≥ 90% , ≤ 100%)	10	S (Superior)
Below 90% but not less than 80% (≥80% , <90%)	9	A+ (Excellent)
Below 80% but not less than 70% (≥70% , <80%)	8	A (Very Good)
Below 70% but not less than 60% (≥60% , <70%)	7	B+ (Good)
Below 60% but not less than 50% (≥ 50% , <60%)	6	B (Average)
Below 50% (<50%)	0	F (Fail)
Absent	0	AB (Absent)

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: “S”, “A+”, “A”, “B+”, “B”.

13.3 A student obtaining Grade “F” shall be considered Failed and will be required to reappear in the examination.

13.5 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 tocompute 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 for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	4	A	8	4 x 8 = 32
Course 2	4	S	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
	20			**159**

$$Thus,\ SGPA = 159 / 21 = 7.57$$

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credits: 24 SGPA: 7	Credits: 24 SGPA: 6	Credits: 24 SGPA: 6.5	Credits: 24 SGPA: 6

$$\text{Thus, } CGPA = \;=\; \frac{24x7 + 24x6 + 24x6.5 + 24x6 \;=\; 6.37}{96}$$

16.0 REVALUATION

If the examinee is not satisfied with the marks awarded, he/she may apply for revaluation of answer book in prescribed format online within three (3) working days from the date of declaration of result of the examination or issue of the statement of marks, whichever is earlier. The revaluation facility shall be for theory papers only. The revaluation of answer book shall not be permitted in respect of the marks awarded to the scripts of practical examination / project work (including theory part) and in viva voce / oral / comprehensive examinations.

The revaluation will be done by a second independent examiner. The result after revaluation shall be as follows:

- The revaluation marks are considered only if the difference between the original award and award on revaluation is more than equal to 15% of 70 marks (11 marks).
- If the difference between the original award and the award on reevaluation is more than 20% (14 marks), a third evaluator is to be appointed and the average of two nearest awards (in the range of 15%) shall be considered.

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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 as per the specified course catalogue, and as indicated above, within four academic years from the date of commencement of his first year first semester, shall forfeit his/her seat in M. Tech. program and his admission shall stand 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:

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	$6.75 \leq$ CGPA < 7.75
Second Class	$6.00 \leq$ CGPA < 6.75

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 subject to the fulfillment of all the academic requirements.

19.0 TERMINATION FROM THE PROGRAM

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

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

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

20.0 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.

21.0 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.

22.0 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.

23.0 TRANSITORY REGULATIONS

25.1 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.

25.2 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.

27.0 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

INSTITUTE OF AERONAUTICALENGINEERING

(AUTONOMOUS)

STRUCTURAL ENGINEERING

COURSE CATALOG – PG21

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BSTC01	Advanced Structural Analysis	PCC	Core	3	0	0	3	30	70	100
BSTC02	Advanced Solid Mechanics	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective-I	PCE	Elective	3	0	0	3	30	70	100
	Professional Core Elective-II	PCE	Elective	3	0	0	3	30	70	100
	Audit Course	Audit - I	Perspective	2	0	0	0	30	70	100
PRACTICAL										
BSTC11	Advanced CAD Laboratory	PCC	Core	0	0	4	2	30	70	100
BSTC12	Advanced Concrete Laboratory	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**08**	**16**	**210**	**490**	**700**

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BSTC13	Finite Element Analysis	PCC	Core	3	0	0	3	30	70	100
BSTC14	Structural Dynamics	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective-III	PCE	Elective	3	0	0	3	30	70	100
	Professional Core Elective-IV	PCE	Elective	3	0	0	3	30	70	100
	Audit Course	Audit - II	Perspective	2	0	0	0	30	70	100
PRACTICAL										
BSTC23	Structural Design Laboratory	PCC	Core	0	0	4	2	30	70	100
BSTC24	Numerical Analysis Laboratory	PCC	Core	0	0	4	2	30	70	100
BSTC25	Mini Project with Seminar	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**12**	**18**	**240**	**560**	**800**

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BHSC11	Research Methodology and IPR	PCC	Core	2	0	0	2	30	70	100
	Professional Core Elective – V	PCE	Elective	3	0	0	3	30	70	100
	Open Elective Courses	OEC	Elective	3	0	0	3	30	70	100
PROJECT										
BSTC31	Phase-I Dissertation	Major Project	Core	0	0	20	10	30	70	100
TOTAL				**08**	**00**	**20**	**18**	**120**	**280**	**400**

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
BSTC32	Phase - II Dissertation	Major Project	Core	0	0	32	16	30	70	100
TOTAL				**00**	**00**	**32**	**16**	**30**	**70**	**400**

PROFESSIONAL CORE ELECTIVE COURSES

PROFESSIONAL COREELECTIVE – I

Course Code	Course Title
BSTC03	Theory of Plates and Shells
BSTC04	Theory and Applications of Cement Composites
BSTC05	Theory of Structural Stability
BSTC06	Composite Materials for Structural Engineering

PROFESSIONAL COREELECTIVE – II

Course Code	Course Title
BSTC07	Analytical and Numerical Methods for Structural Engineering
BSTC08	Advanced Concrete Technology
BSTC09	Structural Optimization
BSTC10	Non-destructive testing and Structural Evaluation

PROFESSIONAL CORE ELECTIVE – III

Course Code	Course Title
BSTC15	Advanced Reinforced Concrete Design
BSTC16	Design of High Rise Structures
BSTC17	Design of Masonry Structures
BSTC18	Elements of Bridge Engineering

PROFESSIONAL CORE ELECTIVE – IV

Course Code	Course Title
BSTC19	Advanced Steel Design
BSTC20	Advanced Design of Foundations
BSTC21	Design of Industrial Structure
BSTC22	Retrofitting and Rehabilitation of Structures

PROFESSIONAL CORE ELECTIVE – V

Course Code	Course Title
BSTC26	Design of Pre stressed Concrete Structures
BSTC27	Analysis of Laminated Composite Plates
BSTC28	Fracture Mechanics of Concrete Structures
BSTC29	Earthquake Resistant design of Structures

OPEN ELECTIVE COURSES

Course Code	Course Title
BAEC30	Elements of Aerospace Engineering
BCSC30	Data Analytics
BESC30	Real Time Operating Systems
BPSC30	Waste to Energy
BCCC30	Operations Research
BSTC30	Project Management and Planning

AUDIT COURSES

Course Code	Course Title
BHSC01	English for Research Paper Writing
BHSC02	Disaster Management
BHSC03	Sanskrit for Technical Knowledge
BHSC04	Value Education
BHSC05	Constitution of India
BHSC06	Pedagogy Studies
BHSC07	Stress Management by Yoga
BHSC08	Personality Development through Life Enlightenment Skills
BHSC09	Business Sustainability and Management
BHSC10	Business Ethics and Corporate Governance

SYLLABUS
(I – III SEMESTERS)

ADVANCED STRUCTURAL ANALYSIS

I Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC01	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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. The main objective is to enable the student to have a good grasp of all the fundamental issues in these advanced topics in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The advanced techniques to know the behavior of structural elements subjected to both vertical and horizontal loads which are used for designing all types of structures.

II. The finite element 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 subjected to different loads.	Understand
CO 2	Analyze continuous beams, portal frames for the given loading conditions using the stiffness, flexibility, approximate methods for ensuring structural efficiency.	Analyze
CO 3	Analyze member forces due to applied loads, lack of fit and temperature changes for the indeterminate trusses.	Analyze
CO 4	Apply the concept of stiffness matrix equations in global coordinate system with boundary condition for analyzing member forces in beams and frame structures.	Apply
CO 5	Explain the shape function concepts of one and two-dimensional elements for enriching knowledge on stiffness matrix.	Understand
CO 6	Make use of modified galerkin method for computing approximate solution of one-dimensional boundary value problems.	Apply

IV.SYLLABUS:

MODULE-I: INFLUENCE COEFFICIENTS (09)

Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.

MODULE-II: STIFFNESS METHOD APPLIED TO LARGE FRAMES (09)

Force method and displacement method, Degree of Freedom, Local Coordinates and Global Coordinates.

MODULE-III: STIFFNESS MATRIX ASSEMBLY OF STRUCTURES AND APPLICATIONS TO SIMPLE PROBLEMS(09)

Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.

Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

MODULE-IV: BOUNDARY VALUE PROBLEMS (BVP) (09)

Boundary Value Problems: Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

MODULE-V: LINEAR ELEMENT (09)

Linear Element: Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.

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.1stEdition, 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 a approach", harper and row publishers, 4th Edition, 2007.

VII. WEB REFERENCES:

1. nptel.ac.in/courses/Webcourse-contents/.../Structural%20Analysis/pdf/m2l7.pdf.
2. https://nptel.ac.in/reviewed_pdfs/105106050/lec1.pdf
3. http://web.iitd.ac.in/~sbhalla/rc717.pdf

VIII. E-TEXT BOOKS:

1. https://phindia.com/.../matrix_methods_of_structural_analysis_theory_and_problems
2. http://www.uomisan.edu.iq/library/admin/book/91314849583.pdf
3. http://priodeep.weebly.com/uploads/6/5/4/9/65495087/w._j._spencer__auth._-

ADVANCED SOLID MECHANICS

I Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC02	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 prismatical bars and plasticity.

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 analysing the structures with in elastic range.	Understand
CO 2	Develop constitutive relationships between stress and strain in linearly elastic solid for analysing the stresses in the field.	Apply
CO 3	Analyze the Stresses and Strains, Strain Displacement and Compatibility Relations for Boundary Value Problems in the Principal Directions.	Analyze
CO 4	Explain the Plane Stress and Plane Strain Problems using Airy's stress Function and Two-Dimensional Problems in Polar Coordinates.	Understand
CO 5	Analyze boundary value problems using Modified Galerkin Method.	Analyze
CO 6	Examine the properties of ideally plastic solids using different yield criterion.	Analyze

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO ELASTICITY (09)

Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.

MODULE-II: STRAIN AND STRESS FIELD (09)
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: EQUATIONS OF ELASTICITY AND TWO-DIMENSIONAL PROBLEMS OF ELASTICITY (09)
Equations of Equilibrium, Stress-Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.

Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

MODULE-IV: BOUNDARY VALUE PROBLEMS (BVP) (09)
Boundary Value Problems: Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

MODULE-V: PLASTIC DEFORMATION (09)
Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

V.TEXT BOOKS:

1. Timoshenko and Goodier, "Theory of Elasticity", McGraw Hill Publishing Company, 3rd Edition, 1970.
2. RagabA.R.,Bayoumi, S.E., "Engineering Solid Mechanics", CRC Press,1st Edition, 1998.
3. Kazimi S. M. A, "Solid Mechanics". Tata McGraw Hill, 2nd Edition, 2017.

VI.REFERENCE BOOKS:

1. SaddM.H, "Elasticity", Elsevier, 3rd Edition, 2014.
2. Ameen. M, "Computational Elasticity", Narosa, 1st Edition, 2008.
3. Srinath, L.S., "Advanced Mechanics of Solids", Tata McGraw Hill, 1st Edition, 2000.

VII. WEB REFERENCES:

1. http://nptel.ac.in/courses/105106049/77
2. https://lecturenotes.in/subject/162/advanced-mechanics-of-solids-amos

VIII. E-TEXT BOOKS:

1. http://nptel.ac.in/courses/105106049/pdf-assignments/main.pdf

THEORY OF PLATES AND SHELLS

I Semester: ST									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC03	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

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 behaviour 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	Analyse
CO 2	Explain Governing differential equations in polar coordinate system of a annular plate subjected to different loading conditions for the design of thin plates.	Understand
CO 3	Examine the governing differential equation of rectangular plates on elastic foundations for the design of foundations.	Analyse
CO 4	Outline the general theory in bending of cylindrical shell, simplified method for analysis and design of the shells.	Apply
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.	Apply
CO 6	Examine the buckling of rectangular plates by compressive forces acting in one and two directions for the analysis of plates.	Analyze

IV. SYLLABUS:

MODULE-I: THIN RECTANGULAR PLATES (09)

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 (09)

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 (09)

Buckling of plates: Governing equation for bending of plate under the combined action of inplane loading and lateral loads, buckling of rectangular plates by compressive forces acting inone 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. WEB REFERENCES:

1. https://pdfs.semanticscholar.org/presentation/ce6d/b61238325d60d3f6dc0f1fbe7af33e397 2c1.pdf

VIII. E-TEXT BOOKS:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-081j-plates-and-shells-spring-2007/readings/lecturenote.pdf.
2. http://community.wvu.edu/~bpbettig/MAE456/Lecture_10_Shell_Elements_b.pdf

THEORY AND APPLICATIONS OF CEMENT COMPOSITES

I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC04	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Concrete as one of the conventional composite material 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 behaviour of composite materials: Ferro cement, SIFCON and Fibre 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	Understand
CO 2	Formulate the constitutive behaviour of various composite materials.	Create
CO 3	Classify the materials based on orthotropic and anisotropic behaviour.	Understand
CO 4	Estimate elastic constants using theories applicable to composite materials.	Evaluate
CO 5	Analyse the structural elements made of cement composites as ferrocement, SIFCON and fibre reinforced concrete.	Analyze
CO 6	Design structural elements made of cement composites as ferrocement, SIFCON and fibre reinforced concrete.	create

IV. SYLLABUS:

MODULE-I: INTRODUCTION (09)

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 (09)

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 (09)

FRC and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.Analysis and Design of Cement Composite Structural Elements: Ferrocement, SIFCON and Fibre 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. WEB REFERENCES:

1. http://nptel.ac.in/courses/101104010/

VIII. E-TEXT BOOKS:

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

THEORY OF STRUCTURAL STABILITY

I Semester: ST									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC05	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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

IV. SYLLABUS:

MODULE-I: CRITERIA FOR DESIGN OF STRUCTURES (09)

Stability, Strength, and Stiffness, Classical Concept ofStability of Discrete and Continuous Systems, Linear and nonlinear behavior.

MODULE-II: STABILITY OF COLUMNS (09)

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

MODULE-III: STABILITY OF FRAMES (09)

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 (09)
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. WEB REFERENCES:

1. http://nptel.ac.in/courses/105106116/10

VIII. E-TEXT BOOKS:

1. https://www.colorado.edu/engineering/CAS/courses.d/Structures.d/IAST.Lect23.d/IAST.Lect23.Slides.pdf

COMPOSITE MATERIALS FOR STRUCTURAL ENGINEERING

I Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC06	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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

IV.SYLLABUS:

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 (09)

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 (09) 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 (09)
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. WEB REFERENCES:

1. http://nptel.ac.in/courses/112104168/L14.pdf

VIII. E-TEXT BOOKS:

1. https://www.amazon.com/Analysis-Performance-Composites-Bhagwan-Agarwal/dp/0471268917

ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

I Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC07	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 1 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	Solve algebraic equations.	Apply
CO 2	Obtain numerical solution of ordinary and partial differential equations.	Apply
CO 3	Develop integration method/s for structural analysis.	Apply
CO 4	Carry out interpolations and curve fitting	Analyze
CO 5	Obtain solution of Eigen value problems and Fourier series for structural analysis.	Analyze
CO 6	Apply iterative and transformation methods in structural engineering	Apply

IV. SYLLABUS:

MODULE-I: UNDAMENTALS OF NUMERICAL METHODS (09)

Error Analysis, Polynomial Approximations and Interpolations, Curve Fitting**;** Interpolation and extrapolation Solution of Nonlinear Algebraic and Transcendental Equations

MODULE-II: ELEMENTS OF MATRIX ALGEBRA (09)

Solution of Systems of Linear Equations, Eigen Value Problems

MODULE-III: NUMERICAL DIFFERENTIATION & INTEGRATION (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 (09)

Implicit & Explicit scheme, solution using Explicit method, Stability analysis of Explicit and Implicit scheme

MODULE-V: COMPUTER ALGORITHMS (09)

Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

V.TEXT BOOKS:

1. AtkinsonK. E., "An Introduction to Numerical Analysis", J. Wiley and Sons, 1989.
2. StevanC.Chopra, Raymond P.Canal, "Numerical Methods for Engineers", McGraw Hill Book Company. April, 2009.

VI. REFERENCE BOOKS:

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

VII. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1. https://nptel.ac.in/courses/105/105/105105043/

ADVANCED CONCRETE TECHNOLOGY

I Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC08	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 prismatical bars and plasticity. This course in reached to student by power point presentations, lecture notes, and assignment questions, seminars, previous model question papers, and question bank of long and short answers.

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.

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

IV. SYLLABUS:

MODULE-I: MATERIALS FORMING CONCRETE (09)

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 (09)

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 (09)

Self-compacting concrete, polymer concrete, fiber reinforced concrete, reactive powder concrete requirements and guidelines, advantages and applications. Light weight concrete, bacteria concrete, ge polymer concrete, self curing concrete, recycled aggregate concrete.

V.TEXT BOOKS:

1. A.M.Neville , "Properties of Concrete", ELBS publications, 2012.
2. A.K. Santhakumar, "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.KrishnaRaju, "Design of Concrete Mixes", CBS Publications, 1996.
3. P.K.Mehta, "Concrete: Micro Structure", ICI, Chennai, 2007.

VII. WEB REFERENCES:

1. http://nptel.ac.in/courses/112104160/3
2. http://nptel.ac.in/downloads/112104160/

VIII. E-TEXT BOOKS:

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

STRUCTURAL OPTIMIZATION

I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC09	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

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 subject 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.	Understand
CO 2	Solve various linear and Non-linear problems.	Apply
CO 3	Solve a problem by geometric programming and dynamic programming.	Apply
CO 4	Apply plastic theory for various structural components	Apply
CO 5	Apply optimization to various structural elements	Apply
CO 6	Evaluate optimization to various structural elements	Evaluate

IV. SYLLABUS:

MODULE-I: INTRODUCTION (09)

Definition, Variables, Objective Function, Constraints, Simultaneous Failure Mode and Design, Classical External Problems

MODULE-II: CALCULUS OF VARIATION (09)

Differential calculus, Optimality criteria, Vibrational Principles with Constraints, Single variable optimization Multivariable optimization

MODULE-IIILINEAR PROGRAMMING (09)

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 structura elements, continuous beams and single storied frames using plastic theory

MODULE-V: DESIGN (09)

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. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

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

NON-DESTRUCTIVE TESTING AND STRUCTURAL EVALUATION

I Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC10	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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. It has been designed to give the student a complete introduction through PPT and video presentation in the magnetic particle and liquid penetrant methods within the field of non-destructive testing.

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.

COURSE OUTCOMES:

After successful completion of the course, students should be able to:		
CO 1	Explain the theory of elasticity including strain/displacement and Hooke's law relationships.	Understand
CO 2	Analyze solid mechanics problems using classical methods and energy methods	Analyze
CO 3	Solve for stresses and deflections of two-dimensional under unsymmetrical loading.	Apply
CO 4	Obtain stresses and deflections of torsion of beams on elastic foundations.	Analyze
CO 5	Apply various failure criteria for general stress states at points.	Apply
CO 6	Explain the concepts of plastic deformation of various criterion.	Understand

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO NON-DESTRUCTIVE TESTING (NDT) (09)

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 (09)

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 (09)

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. "Guide book on non-destructive testing of concrete structures," Training course series no. 17, International Atomic Energy Agency, Vienna, 2002.

VII. WEB REFERENCES:

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/

VIII. E-TEXT BOOKS:

1. http://www-pub.iaea.org/mtcd/publications/pdf/tcs-17_web.pdf

ADVANCED CAD LABORATORY

<table>
<tr><td colspan="10">I Semester: ST</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td rowspan="1">BSTC11</td><td>Core</td><td>0</td><td>0</td><td>4</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Total Tutorials: Nil</td><td colspan="4">Total Practical Classes: 36</td><td colspan="3">Total Classes: 36</td></tr>
</table>

I. COURSE OVERVIEW:

This course deals with the drawing of various structural drawings 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.	Analyze
CO 2	Analyze technical drawings using both CAD and basic manual tools.	Analyze
CO 3	Develop the drawings of structural elements for different applications.	Apply
CO 4	Build the different stages of the structure from scratch using engineering graphics techniques such as sectional projections, dimensioning and computer-generated drawings.	Apply
CO 5	Make use of software packages for creating different structural Geometry.	Apply
CO 6	Apply principles of technical drawings for producing different 3D models.	Apply

IV. SYLLABUS:

Week-I: DESIGN OF SLABS

Program for design of slabs using Excel and detailing

Week-II: DESIGN OF BEAMS

Program for design of beams using Excel and detailing

Week-III: DESIGN OF COLUMN USING EXCEL

Program for design of column using Excel and detailing

Week-IV: DESIGN OF FOOTING USING EXCEL

Program for design of footing using Excel and detailing

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

Week-VI: INTRODUCTION TO SOFTWARES

Introductionto analysis and design software's

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

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

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

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

V.TEXT BOOKS:

1. Terence M. Shumaker, David A., Madsen AutoCAD and Its Applications: Advanced AutoCAD, Goodheart-Wilcox, 12th Edition, 2005

VI.REFERENCE BOOKS:

1. Dr M.N. SeshaPraksh and Dr. G.S. Servesh, "Computer Aided Design Laboratory", Laxmi Publications, 1st Edition, 2016.
2. Mastering Auto Cad 2016 and AutoCad LT from AUTODesk, 2016.

VII. WEB REFERENCES:

1. https://structuralbd.com/dwg-file-sample/
2. https://dwgmodels.com/construction_details/

VIII. E-TEXT BOOKS:

1. https://books.google.co.in/books/about/AutoCAD_and_Its_Applications.html?id=BAaznio6H5oC&redir_esc=y

ADVANCED CONCRETE LABORATORY

I Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC12	Core	L	T	P	C	CIA	SEE	Total
		0	0	4	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

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

II. COURSE OBJECTIVES:

The 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.	Apply
CO 2	Develop the correlation between cube strength and cylinder strength for understanding the different codal provisions other than IS.	Analyze
CO 3	Determine the relation between compressive strength and split tensile strength for the analysis of concrete in tension.	Analyze
CO 4	Identify the relation between the compressive strength and modulus of rupture of concrete for understanding the behavior of concrete in rupture.	Analyze
CO 5	Test for the Non-Destructive testing of concrete members using rebound hammer and ultrasonic pulse velocity.	Analyze
CO 6	Explain the behavior of beams under flexure, shear and torsion for design purpose.	Understand

IV. SYLLABUS:

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 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 AND MODLUS OF RUPTURE
Effect of cyclic loading on steel.

Week-VII: NON – DESTRUCTIVE TEST (NDT)
Non-Destructive testing 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.

V.TEXT BOOKS:

1. Shetty, M. S., "Concrete Technology", S. Chand and Co. Publishers, 3rd Edition, 2006.

VI.REFERENCE BOOKS:

1. Mastering Auto cad 2016 and Auto Cad LT 2016 from AUTO Desk.
2. Dr. M.N. SeshaPraksh and Dr. G.S. Servesh, "Computer Aided Design Laboratory", Laxmi Publications, 1st Edition, 2016.

VII. WEB REFERENCES:

1. http://kec.edu.np/wp-content/uploads/2017/06/Advanced-Concrete-Technology.pdf.

VIII. E-TEXT BOOKS:

1. http://alphace.ac.in/downloads/notes/cv/10cv81.pdf.

FINITE ELEMENT ANALYSIS

II Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC13	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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.	Understand
CO 2	Outline the concepts of elasticity, plane stress and plane strain conditions for the design purpose.	Understand
CO 3	Analyze the one- and two-dimensional structures using beam and bar elements.	Analyze
CO 4	Explain the concepts of iso-parametric elements for the analysis of Structures.	Understand
CO 5	Analyze the plates like slabs using plate elements.	Analyze
CO 6	Summarize the concepts of non-linear analysis for analyzing the real world situations	Understand

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO FEM AND PRINCIPLES OF ELASTICITY (09)

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 (09)

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 (09)

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 non linear 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. WEB REFERENCES:

1. http:// nptel.ac.in/courses/105106051/
2. http:// nptel.ac.in/courses/1051050

VIII. E-TEXT BOOKS:

1. http://web.mit.edu/16.810/www/16.810_L4_CAE.pdf

STRUCTURAL DYNAMICS

II Semester: ST									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC14	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

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

II. COURSE OBJECTIVES:

The 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 subjected to earthquakes and blasts for the efficient and economic design of structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:		
CO 1	Explain the concepts of equation of motion of a dynamic system and different loads acting on the structures for understanding the behavior of structures.	Understand
CO 2	Outline the concept of damped vibrations of single degree freedom systems for the analysis of structures subjected to dynamic loads.	Understand
CO 3	Develop the expressions for response of single degree freedom systems based on loading function for the response of structure used in design.	Apply
CO 4	Develop the equations of structural response to dynamic loads using Duhamel's integral and fourier analysis.	Apply
CO 5	Analyse the two-degree freedom systems subjected to free and forced vibrations for the design purpose.	Analyse
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.	Analyse

IV. SYLLABUS:

MODULE-I: THEORY OF VIBRATIONS (09)

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

MODULE-II: DAMPED VIBRATIONS OF SDOF SYSTEM (09)

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 (09)

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

V.TEXT BOOKS:

1. S. Kavita and S. R. Damodaraswamy, "Basics of structural Dynamics and Aseismic Design", PHI Learning Pvt. Ltd., 1st Edition, 2012.
2. Clough R. W. and Penzien J, "Dynamics of Structures", 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. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1. http://scmero.ulb.ac.be/Teaching/Courses/MECA-H-303/MECA-H-303-Lectures.pdf

ADVANCED REINFORCED CONCRETE DESIGN

II Semester: ST									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC15	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 behaviour in terms of shear force and bending moment.
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 behaviour of reinforced concrete under flexure and shear for designing beams, slabs and columns under various load condition.	Understand
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.	Understand
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.	Analyse
CO 4	Analyse the load distribution in deep beams for designing and fixing of reinforcement details in deep beams.	Analyse
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.	Apply
CO 6	Analyse the soil properties for designing various types of footings for transferring the superimposed loads safely to the soil beneath.	Analyse

IV. SYLLABUS:

MODULE-I: BASIC DESIGN CONCEPTS (09)

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 (09)

Rotation of a plastic hinge, redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, applications for fixed and continuous beam. Yield line analysis for slabs: Upper bound and lower bound theorems, yield line criterion, virtual work and equilibrium methods of analysis for square and circulars labs with simple and continuous end conditions.

MODULE-III: DESIGN OF RIBBED SLABS, FLAT SLABS (09)

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 corbels, design of procedure of corbels, design of nibs.

MODULE-V: DESIGN OF COMPRESSION MEMBERS (09)

Estimation of effective length of a column, code requirements on slenderness limits, design of short columnsunder axial compression, design of short columns with uni-axial bending, design of short columns under biaxialbending, design of slender columns. Design of combined footings, distribution of soil Pressure, geometry oftwo Column combined footing, design considerations in combined footing for two, columns.

V.TEXT BOOKS:

1. Pillai S. U. and MenonD, ‘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. SalmonC. G., Johnson J. E. and Malhas F. A. “Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design”, Pearson Education, 5th Edition, 2009.
4. Ramchandra, “Design of Steel Structures”,Vol. II, Standard Book House, Delhi, 1999.
5. Neal B.G, “Plastic Methods of Structural Analysis”, Chapman and Hall London, 2005.

VII. WEB REFERENCES:

1. https://lecturenotes.in/subject/179/design-of-advanced-concrete-structures-dacs

VIII. E-TEXT BOOKS:

1. http://nptel.ac.in/downloads/105105104/

DESIGN OF HIGH-RISE STRUCTURES

II Semester: ST									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC16	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 behaviour 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	Analyze
CO 2	Identify about different systems and various loads in Tall structures.	Apply
CO 3	Identify about various structural systems and their behavior.	Apply
CO 4	Interpret static, dynamic and stability analysis of various systems.	Understand
CO 5	Classify various Flooring systems and modern progress of tall structures.	Understand
CO 6	Develop Application of software in analysis and design.	Apply

IV. SYLLABUS:

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 (09)

Foundation design for varied soil strata.

MODULE-III: TALL BUILDINGS (09)

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

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

MODULE-IV: FIREFIGHTING PROVISION OF TALL BUILDINGS(09)
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. WEB REFERENCES:

1. http://nptel.ac.in/courses/105106113/13

VIII. E-TEXT BOOKS:

1. http://www.byggmek.lth.se/fileadmin/byggnadsmekanik/publications/tvsm5000/web5213.pdf

DESIGN OF MASONRY STRUCTURES

II Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC17	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 behaviour 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 behaviour 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:

I. Structural analysis of load bearing brick and block masonry.
II. Structural design of walls, columns and beams in unreinforced and reinforced masonry.
III. 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	Understand
CO 2	Assess the strength and stability of masonry walls	Evaluate
CO 3	Identify the various interactions involved in structural elements	Apply
CO 4	Describe the effect of curing, ageing and workmanship of a masonry wall	Understand
CO 5	Explain the design aspects of reinforced masonry	Understand
CO 6	Make use of various model techniques for analyzing the components	Apply

IV. SYLLABUS:

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 (09)

Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane Loading. Shear

Strength and Ductility of Reinforced Masonry Members

MODULE-III: INTERACTIONS (09)

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 (09)

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. NarendraTaly, "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, 2014.

VI. REFERENCE BOOKS:

1. Toma_evi_Miha, Earthquake-resistant Design of Masonry Buildings, Imperial College Press, 1999.

VII. WEB REFERENCES:

1. http://nptel.ac.in/courses/105102088/28

VIII. E-TEXT BOOKS:

1. http://civil.iisc.ac.in/ksnseminar.pdf

ELEMENTS OF BRIDGE ENGINEERING

II Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC18	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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.	Understand
CO 2	Analyze the box culverts for the given loading and detail the box culverts.	Analyze
CO 3	Design and detail of T-Beam bridges.	Create
CO 4	Design and check the stability of piers and abutments.	Create
CO 5	Discuss the bridge foundations and prepare the bar bending schedule	Understand
CO 6	Analyze the bridge decks and substructures for various conditions	Analyze

IV.COURSE SYLLABUS:

MODULE-I: CONCRETE BRIDGES (09)

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

MODULE-II: SOLID SLAB, GIRDER BRIDGES & CONTINUOUS BRIDGES (09)

Introduction, method of design. Girder bridges, introduction, method of design, courbon's theory. Continuous bridges, introduction span lengths, analysis of continuous bridges, decking of girders with constant moment of inertia, continuous bridges with variable moment of inertia, method of analysis, girders with parabolic soffit, method of plotting influence lines, girders with straight haunches, design steps for continuous bridges.

MODULE-III: PRE-STRESSED CONCRETE BRIDGES: FUNDAMENTALS (09)

Basic principles, method of pre-stressing-pre tensioning and post-tensioning, comparison, freyssinet method, magnel, blanet system-lee-mc call system basic assumptions.

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

MODULE-IV: PRE-STRESSED CONCRETE BRIDGES: DESIGN (09)

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. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1. http://www.highestbridges.com/pdf/Waddell%20-%20Bridge%20Engineering.pdf
2. https://accessengineeringlibrary.com/browse/bridge-engineering-second-edition
3. https://drive.google.com/file/d/0BwoIGOzEq0cMMy02VVFmR2Zad3M/edit

ADVANCED STEEL DESIGN

II Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC19	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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

IV. SYLLABUS:

MODULE-I: SIMPLE CONNECTIONS –RIVETED, BOLTED PINNED AND WELDED CONNECTIONS (09)

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 (09)

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 (09)

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, hopperbottom 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. Web References:

1. http://nptel.ac.in/courses/105106113/

VIII. E-Text Books:

1. https://www.iare.ac.in/sites/default/files/lecture_notes/lec%20notes%20ASD.pdf

ADVANCED DESIGN OF FOUNDATIONS

II Semester: ST									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC20	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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.	Analyze
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.	Evaluate
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.	Analyze
CO 4	Examine the theories and recommended provisions to avoid underground structures free from the collapse and tilting.	Analyze
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.	Evaluate
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.	Analyze

IV.SYLLABUS:

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 (09)
Requirements for Satisfactory Performance of Foundations, Methods ofEstimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations usingField Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

MODULE-III: PILE FOUNDATIONS (09)
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. Tunnelsan Arching in Soils, Pressure Computations around Tunnels.

MODULE-V: OPEN CUTS, COFFER DAMS (09)
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. WEB REFERENCES:
1. http://nptel.ac.in/courses/105105039/

VIII. E-TEXT BOOKS:
1. https://lecturenotes.in/subject/244/advanced-foundation-engineering-afe

DESIGN OF INDUSTRIAL STRUCTURES

II Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC21	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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

IV.SYLLABUS:

MODULE-I: STEEL GANTRY GIRDERS (09)

Introduction, loads acting on gantry girder, permissible stress, types ofgantry 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 (09)

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 loa 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 (09)

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. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1. http://nptel.ac.in/downloads/105106113/

RETROFITTING AND REHABILITATION OF STRUCTURES

II Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC22	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

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. For an existing structure of good condition, the cost of retrofitting tends to be smaller than the replacement cost. Thus, the retrofitting of structures is an essential component of long term disaster mitigation.

II. 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.	Understand
CO 2	Interpret the importance and facets of maintenance for scheduling regular inspection of residential and industrial structures.	Understand
CO 3	Summarize corrosion protection methods of steel and deterioration of materials for protecting structures from rusting and fatigue failures.	Understand
CO 4	Identify the materials and technics of repair for rehabilitation and retrofitting of structures.	Apply
CO 5	Make use of non-destructive testing procedures, demolition methods for assessing and improving the performance of structures.	Apply
CO 6	Select suitable engineered and non-engineered techniques in existing structures for strengthening and demolition.	Apply

IV.COURSE SYLLABUS:

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 (09)

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 (09)

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 (09)

Special concrete and mortar, concrete chemicals, expansive cement, polymer concrete sulphur infiltrate concrete, ferro cement, fiber reinforced concrete, methods of repair in concrete, steel, masonry and timbe 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. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1. https://www.amazon.in/REPAIRREHABILITATIONCONCRETESTRUCTURESPOONAMebook/dp/B01CVPPWRW
2. https://www.amazon.in/Concrete-Structures-ProtectionRepairRehabilitationebook/dp/B002ZJSVJ6

STRUCTURAL DESIGN LABORATORY

II Semester: ST									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC23	Core	L	T	P	C	CIA	SEE	Total
		0	0	4	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes: 36		

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. STAADPro 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.	Understand
CO 2	Analyse the trusses subjected to different loading conditions using indian standard specifications.	Analyse
CO 3	Analyse the rigid jointed frames subjected to different loading conditions using indian standard specifications.	Analyse
CO 4	Design of steel 2D and 3D trusses for industrial and bridge structures.	Analyse
CO 5	Design of reinforced concrete rigid frames for multistoried structures.	Analyse
CO 6	Make use of latest tools for analysis and design of sub-structures	Apply

IV. SYLLABUS:

Week-I: INTRODUCTION TO STAAD SOFTWARE

Introduction

Week-II: STRUCTURAL SYSTEMS

General Description-Type of structure, Unit systems, structure geometry and Coordinate 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 OF BEAM AND TRUSS

Analysis of 2D Truss using STAAD Pro.

Analysis of continuous Beams using STAAD Pro.

Week-VIII: ANALYIS OF RIGID FRAMES

Analysis of 2D and 3D Rigid Frames using STAAD Pro.

Week-IX: DESIGN OF RC STRUCTURAL ELEMENTS

Design of RC framed structures (Beams, columns, slabs, footings) using STAAD Pro

Design of circular water tanks using STAAD Pro.

Week-X: 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. SivakumarNaganathan, "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. Web References:

1. https://onlinecourses.nptel.ac.in/noc17_ce21/preview.

VIII. E-Text Books:

1. https://civildigital.com/staad-pro-v8i-video-tutorials/.

NUMERICAL ANALYSIS LABORATORY

II Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC24	Core	L	T	P	C	CIA	SEE	Total
		0	0	4	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes: 36		

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.	Analyze
CO 2	Evaluate the curve fitting by using method of least squares approximations.	Evaluate
CO 3	Determine the linear system of equations using gauss elimination, gauss seidal and gauss Jordan methods.	Analyze
CO 4	Solve the integrations numerically using trapezoidal and simpson's rule.	Apply
CO 5	Explain the numerical solution of ordinary differential equations using Euler's Method.	Analyze
CO 6	Analyze the numerical solution of ordinary differential equations by using Runge- Kutta Method.	Apply

IV.COURSE SYLLABUS:

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.

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. WEB REFERENCES:

1. http://www.iitg.ac.in/physics/fac/charu/courses/ph508/lab5.pdf

VIII. E-TEXT BOOKS:

1. https://www.researchgate.net/publication/275014975_A_Numerical_Analysis_Lab_Solving_System_of_Linear_Equations

MINI PROJECT WITH SEMINAR

<table>
<tr><td colspan="9">II Semester: ST</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">BSTC25</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 45</td><td colspan="3">Total Classes:45</td></tr>
</table>

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.

RESEARCH METHODOLOGY AND IPR

III Semester: CSE, ES, CAD/CAM, AE, ST, PEED								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC11	Core	L	T	P	C	CIA	SEE	Total
		2	-	-	2	30	70	100
Contact Classes: 30	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:30		

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 students 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:

CO1	Interpret the technique of determining a research problem for a crucial part of the research study.	Remember
CO2	Examine the way of methods for avoiding plagiarism in research.	Apply
CO3	Apply the feasibility and practicality of research methodology for a proposed project.	Apply
CO4	Make use of the legal procedure and document for claiming patent of invention.	Understand
CO5	Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP.	Understand
CO6	Defend the intellectual property rights throughout the world with the involvement of world intellectual property organization	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION (9)

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 9)

Effective literature studies approaches, analysis Plagiarism, Research ethics.

MODULE – III: RESEARCHPROPOSAL

Effective technical writing, how to write report, Paper Developing a Research Proposal.

Format of research proposal, presentation and assessment by iare view committee

MODULE – IV: PATENTING (9)

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 (9)

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. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering student".
2. Wayne Goddard and Stuart Melville ,"Research Methodology: An Introduction"
3. RanjitKumar, "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. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.

VII. WEB REFERENCES:

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
2. T.Ramappa,"Intellectual Property Rights Under WTO",S.Chand, 2008.

VIII. E-TEXT BOOKS:

1. http://nptel.ac.in/courses/107108011/

DESIGN OF PRE STRESSED CONCRETE STRUCTURES

III Semester: ST									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC26	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

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. Effect of non-prestressed steel; ductility; transfer strength; design for shear-effect of prestress on shear; stirrup design. Special problems in prestressing: losses; effect of creep and shrinkage; end block design-bursting and spalling forces in post anchorages; transmission lengths in pre-tensioned members. Statically indeterminate beams: introduction to continuous prestressed concrete beams; secondary moments.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The concepts of prestressed concrete structures and the behaviour of these structures subjected to loads for the design purpose.
II. 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 concepts of stresses and strains developed within the structures subjected to different loads and their combinations for understanding the behavior of prestressed concrete structures.	Understand
CO 2	Elucidate the concept of methods of pre and post tensioning and the systems of prestressing for the designing of prestressed concrete structural elements	Understand
CO 3	Estimate the losses in the prestress and post tensioned members for the efficient design of prestressed concrete structures.	Analyze
CO 4	Design prestressed and post tensioned structural elements using Indian standard code method.	Apply
CO 5	Summarize the concepts of transfer of prestress in pre and post tensioned members by bond and transmission length using Indian standard code method.	Understand
CO 6	Design the composite prestressed concrete structural elements subjected to flexure and shear for designing multi storied structures.	Apply

IV.COURSE SYLLABUS:

MODULE-I: INTRODUCTION TO PRESTRESSED CONCRETE (09)

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 (09)

Analysis of sections for flexure, beams pre-stressed with straight, concentric, eccentric, bent and parabolictendons- 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 byhorizontal 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 (09)

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. Web References:

1. http://nptel.ac.in/courses/105106117/

VIII. E-Text Books:

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

ANALYSIS OF LAMINATED COMPOSITE PLATES

III Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC27	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 fa-tigue 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.	Understand
CO 2	Assess the failure criterion and fracture mechanics of composites.	Understand
CO 3	Analyze the rectangular composite plates using the analytical methods.	Analyze
CO 4	Analyze the composite plates using advanced finite element method	Analyze
CO 5	Develop the computer programs for the analysis of composite plates	Create
CO 6	Analyze the rectangular laminated plates using finite element methods	Analyze

IV.COURSE SYLLABUS:

MODULE-I: INTRODUCTION (09)

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 (09)

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,Formatio of Load Vector, Numerical Integration, Post Computation of Stresses

MODULE-V: FEM MODELLING OF LAMINATED PLATES (09)

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. WEB REFERENCES:

1. http://ethesis.nitrkl.ac.in/5685/1/110ME0327-3.pdf

VIII. E-TEXT BOOKS:

1. http://ethesis.nitrkl.ac.in/5878/1/110ME0335-6.pdf

FRACTURE MECHANICS OF CONCRETE STRUCTURES

III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC28	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

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	Analyze
CO 2	Explain the energy concepts in crack and crack resistance for the analysis of structural components.	Evaluate
CO 3	Demonstrate the linear elastic fracture mechanics for the propagation of cracks.	Analyze
CO 4	Interpret the importance of Crack tip plastic zone for durable concrete structures.	Analyze
CO 5	Explain micromechanics and various models in crack for fracture mechanics models.	Analyze
CO 6	Describe the crack propagation concepts for the applications of concrete structures.	Evaluate

IV.COURSE SYLLABUS:

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 (09)
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 (09)
General concepts, crack models, band models, models based on continuum damage mechanics

MODULE-V: APPLICATIONS TO CONCRETE STRUCTURES (09)
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. BroekDavid, "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. WEB REFERENCES:

1. http://www.nptel.ac.in/courses/112106065/#

VIII. E-TEXT BOOKS:

1. http://www.civil.northwestern.edu/people/bazant/PDFs/Papers/P90.pdf

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

III Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC29	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose. A clearly defined objective directs a researcher in the right direction. Clearly defined objectives are important feature of a good research study. Without a clear objective a researcher is aimless and directionless in conducting the study. Without focused objectives, no replicable scientific findings can be expected. The objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act.

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

IV.COURSE SYLLABUS:

MODULE-I: EARTHQUAKE GROUND MOTION AND STRUCTURAL DYNAMICS (09)

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 (09)

Basic elements of earthquake resistant design, identification of seismic damages in RCC buildings, effectof structural irregularities on performance of RCC buildings during earthquakes, earthquake resistant building architecture.

MODULE-III: SEISMIC ANALYSIS AND MODELING OF RCC STRUCTURES (09)

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 wall based on IS 13920 code, capacity based design

MODULE-V: EARTHQUAKE RESISTANT DESIGN OF MASONRY STRUCTURES (09)

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-storeymasonry buildings.

V.TEXT BOOKS:

1. Earthquake resistant design of structures – S. K. Duggal, Oxford University Press, 2009.
2. Earthquake resistant design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd, 2001.
3. Seismic design of reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, 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, “Masory 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. WEB REFERENCES:

1. http://www.nicee.org/iaee/E_Chapter3.pdf
2. http://www.iitk.ac.in/nicee/wcee/article/vol.3_session4_1917.pdf

V. E-TEXT BOOKS:

1. https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/BSSC/FEMA_P-749.pdf

ELEMENTS OF AEROSPACE ENGINEERING

III Semester: COMMON FOR ALL BRANCHES								
Course Code	Category	Hours /Week			Credits	Maximum Marks		
BAEC30	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Aeronautical engineering is the specialized branch of engineering and study of science that deals with design, construction, maintenance of various aircrafts and their components. Candidates who have an inclination towards airplanes and their mechanisms can opt to study aeronautical engineering.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Historical evaluation of Airplanes
II. The different component systems and functions
III. The various types of power plants used in aircrafts

III. COURSE OUTCOMES:

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

CO 1	Learn the history of aircraft & developments over the years	Understand
CO 2	Understand ability to identify the types & classifications of components and control systems	Understand
CO 3	Understand the basic concepts of flight & Physical properties of Atmosphere	Understand
CO 4	Understand the different Newtonian law and its application in aerospace domain	Understand
CO 5	Explain the Different types of Engines and principles of Rocket	Understand
CO 6	Understand ability to differentiate the types of fuselage and constructions	Understand

IV. COURSE SYLLABUS:

MODULE-I: HISTORY OF FLIGHT (07)

Balloon flight-ornithopers-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

MODULE-II: AIRCRAFT CONFIGURATIONS AND ITS CONTROLS (08)

Different types of flight vehicles, classifications-Components of an airplane and their functions-Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

MODULE-III: BASICS OF AERODYNAMICS (06)

Physical Properties and structures of the Atmosphere, Temperature, pressure and altitude relationships, Newton's Law of Motions applied to Aeronautics-Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers.

MODULE-IV: BASICS OF PROPULSION (06)

Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production-Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space.

MODULE-V: BASICS OF AIRCRAFT STRUCTURES (06)

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials. Stresses and strains-Hooke's law- stress-strain diagrams-elastic constants-Factor of Safety.

V. TEXT BOOKS:

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th Edition, 2015
2. Stephen.A. Brandt, Introduction to aeronautics: A design perspective, AIAA Education Series, 2nd Edition 2004.

VI. REFERENCE BOOKS:

Kermode, A.C. "Flight without Formulae", Pearson Education, 11th Edition, 2011.

VII. WEBREFERENCES:

1. http://memberfiles.freewebs.com/94/47/55224794/documents/airport%20planning%20and%20management.pdf
2. https://books.google.co.in/books?id=RYR6cu4YSBcC&dq=Planning%20and%20Design%20of%20Airports&source=gbs_similarbooks

VIII. E-TEXTBOOKS:

https://nptel.ac.in/courses/101/101/101101079/

DATA ANALYTICS

III Semester: COMMON FOR ALL BRANCHES								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCSC30	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course covers the fundamentals of data analysis, such as data gathering or data mining .this course covers concepts of data analysis, regression analysis, organization structures, forecasting techniques and decision analysis. The *data analytics* tools help in the data mining processes from loading to transformation, aggregation, automated parameter, and process optimization.

II. COURSE OBJECTIVES

The students will try to learn:

I. The role of business analytics within an organization.
II. The relationships between the underlying business processes of an organization.
III. To gain an understanding of how managers use business analytics to formulate

III COURSE OUTCOMES:

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

CO1	Analyze data using statistical and business analytics technology	Analyze
CO2	Solve business problems and to support managerial decision making	Apply
CO3	Choose business decision Strategies with the without outcome probabilities	Apply
CO4	Perform statistical analysis on variety of data	Apply
CO5	Experiment Data using Business Analytics Technology	Apply

IV. COURSE SYLLABUS:

MODULE – I: BUSINESS ANALYTICS (09)

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

MODULE – II: REGRESSION ANALYSIS (09)

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

MODULE – III: ORGANIZATION STRUCTURES (09)

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

MODULE – IV: FORCASTING TECHNIQUES (09)

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

MODULE – V: DECISION ANALYSIS (09)

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

V. TEXT BOOKS

1. James Evans, "Business Analytics", Persons Education.

VI. REFERENCE BOOKS

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications", Pearson FT Press.

VII. WEB REFERENCES

1.http://nptel.ac.in/courses/110107092/

VIII. E-TEXT BOOKS

1.http://nptel.ac.in/downloads/110107092/

REAL TIME OPERATING SYSTEMS

III Semester: COMMON FOR ALL BRANCHES								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BESC30	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:45		

I. COURSE OVERVIEW:

This course is to introduce students with the basic concepts and approaches in the design and analysis of real-time operating systems. It covers design considerations of real time operating systems, task scheduling, threads, multitasking, task communication and synchronization. Applications of the course include real time operating systems in image processing, fault tolerant applications and control systems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts of operating systems and principles of real time operating system, implementation aspects of real time concepts in embedded systems.

II. The design of real time operating system by using the concepts of Timers, I/O subsystem and Memory management units.

III. Software development process and tools like Vxworks and muCOS for real timeoperating system applications.

III. COURSE OUTCOMES:

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

CO1	Recall real time operating system to provide resource managementand synchronization for communication systems.	Understand
CO2	Compare soft real-time operating system and hard real-timeoperating systems for the priority based task scheduling.	Analyze
CO 3	Outline the components of real time operating systems for the designof reliable embedded system.	Understand
CO 4	Analyze finite state machine for the task scheduling and execution inkernel models.	Analyze
CO 5	Develop a semaphore token for the execution of one or more threadsin mutual exclusion.	Create
CO 6	Interpret message queue in asynchronous communications protocolfor send and receive messages simultaneously.	Understand

IV. SYLLABUS:

MODULE – I: REAL TIME OPERATING SYSTEM PRINCIPLES (10)

History of operating systems, defining RTOS, classification of real-time systems, The scheduler, objects, services and key characteristics of RTOS, Tasks: Defining a task, task states and scheduling, typical task operations, typical task structure.

MODULE – II: REAL TIME KERNEL OBJECTS (09)

Semaphores: Defining semaphores, typical semaphore operations, typical semaphore use; Message Queues: Defining message queues, message queue states, message queue content, message queue storage, typical message queue operations; Typical message queue use other kernel objects: Pipes, event registers, signals, condition variables.

MODULE – III: RTOS DESIGN CONSIDERATIONS (08)
Timer and Timer Services: Real-time clocks and system clocks, programmable interval timers, timer interrupt service routines, model for implementing the soft-timer handling facility, timing wheels.
I/O sub system: Basic I/O concepts, the I/O sub system; Memory management: Dynamic memory allocation, fixed-size memory management, blocking vs. Non-blocking memory functions, hardware memory management units.

MODULE – IV: TASKS COMMUNICATION AND SYNCHRONIZATION (08)
Synchronization and Communication: Synchronization, communication, resource synchronization methods, common practical design patterns; common design problems: Resource classification, deadlocks, priority inversion.

MODULE – V: RTOS APPLICATION DOMAINS (10)
Comparison and study of RTOS: Vxworks and COS, Case studies: RTOS for image processing, embedded RTOS for voice over IP, RTOS for fault tolerant applications, RTOS for control systems.

V. TEXT BOOKS:

1. Andrew Troelsen,"Pro C and the .NET 4 Platform, Springer (India) Private Limited, New Delhi, India, 5th Edition, 2010.
2. David Chappell, "Understanding .NET – A Tutorial and Analysis", Addison Wesley, 2nd Edition, 2002.
3. S. Thamarai Selvi, R. Murugesan, A Textbook on C, Pearson Education, 1st Edition, 2003.

VI. REFERENCE BOOKS:

1. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI, 1st Edition, 1999.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Kindle Publishers, 2nd Edition, 2005.
3. Tanenbaum, "Modern Operating Systems", Pearson Edition, 3rd Edition, 2007.

VII. WEB REFERENCES:

1. https://www.jntumaterials.co.in
2. http://www.inf.ed.ac.uk/teaching/courses/es/PDFs/RTOS.pdf
3. https://nptel.ac.in/courses/106108101/pdf/Lecture_Notes/Mod%208_LN.pdf
4. http://wwww.iare.ac.in

VIII. E-TEXT BOOKS:

1. http://www.bookzz.org/
2. http://www.jntubook.com
3. http://www.4shared.com/web/preview/pdf/BhrrT3m0
4. http://www.archive.org

WASTE TO ENERGY

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BPSC30	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

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 students 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 will 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.	Apply
CO 2	Illustrate the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.	Understand
CO 3	Understand the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.	Understand
CO 4	Outline the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Understand
CO 5	Apply the knowledge in planning and operations of waste to Energy plants by following legal legislation related to solid waste management.	Apply
CO 6	Illustrate the thermo-chemical conversion of Biogas by using Gasification process for energy generation.	Understand

IV. SYLLABUS

MODULE –I: WASTE SOURCES & CHARACTERIZATION (09)

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 (09)

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 (09)

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:

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

VI. REFERENCE BOOKS:

4. Challal, D S, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.
5. C Y Were Ko-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1st Edition, 1996.
6. C Parker and T Roberts (Ed), "Energy from Waste", An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
7. KL Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, Reprint Edition, 2000.
8. M Datta, "Waste Disposal in Engineered Landfills", Narosa Publishing House, 1997

VII. WEB REFERENCES:

4. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
5. https://www.What is the impact of E-waste: Tamara Thompson
6. https://www. E-waste poses a Health Hazard: SairudeenPattazhy

VIII. E-TEXT BOOKS:

4. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
5. https://www.What is the impact of E-waste: Tamara Thompson
6. https://www. E-waste poses a Health Hazard: SairudeenPattazhy

OPERATIONS RESEARCH

III Semester: COMMON FOR ALL BRANCHES								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCCC30	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Operations Research (OR) is a discipline that helps to make better decisions in complex scenarios by the application of a set of advanced analytical methods. It couples theories, results and theorems of mathematics, statistics and probability with its own theories and algorithms for problem solving. Applications of OR techniques spread over various fields in engineering, management and public systems. This course includes the following topics : Linear Programming, Transportation problems, Assignment and Theory of games problems. Advanced topics on waiting line and simulation.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The description, characteristics of operation research and mathematical model of real time problem for optimization.
II. Establish the problem formulation by using linear, dynamic programming, game theory and queuing models.
III. Apply stochastic models for discrete and continuous variables to control inventory.
IV. Visualize the computer-based manufacturing simulation models.

III. COURSE OUTCOMES:

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

CO1	Recall the basics of operation research	Remember
CO2	Explain the characteristics and scope of OR	Understand
CO3	Select optimal problems solving techniques for a given problem using LP	Apply
CO4	Solve transportation, travelling sales man and Assignment problems	Apply
CO5	Demonstrate and solve simple models of Game theory.	Understand
CO6	Choose appropriate simulation model for practical application	Apply

IV. COURSE SYLLABUS:

MODULE -I: INTRODUCTION AND ALLOCATION (09)

Development, definition, characteristics and phases, types of operation research models, applications; Allocation: linear programming, problem formulation, graphical solution, simplex method, artificial variables techniques, two–phase method, big-M method.

MODULE -II: TRANSPORTATION AND ASSIGNMENT PROBLEM (09)

Transportation problem: Formulation, optimal solution, unbalanced transportation problem, degeneracy; Assignment problem, formulation, optimal solution, variants of assignment problem, traveling salesman problem.

MODULE -III: SEQUENCING AND REPLACEMENT (09)

Sequencing: Introduction, flow, shop sequencing, n jobs through two machines, n jobs through three machines, job shop sequencing, two jobs through "m" machines.

Replacement: Introduction: Replacement of items that deteriorate with time, when money value is not counted and counted, replacement of items that fail completely, group replacement.

MODULE -IV: THEORY OF GAMES AND INVENTORY (09)

Theory Of Games: Introduction, minimax (maximin) criterion and optimal strategy, solution of games with saddle points, rectangular games without saddle points, dominance principle, mx2 and 2xn games, graphical method; Inventory: Introduction, single item, deterministic models, purchase inventory models with one price break and multiple price breaks, shortages are not allowed, stochastic models, demand may be discrete variable or continuous variable, instantaneous production, instantaneous demand and continuous demand and no set up cost, single period model.

MODULE -V: WAITING LINES AND SIMULATION (09)

Waiting Lines: Introduction, single channel, poisson arrivals , exponential service times, with infinite population and finite population models, multichannel, poisson arrivals, exponential service times with infinite population single channel Poisson arrivals; Simulation: Definition, types of simulation models, phases of simulation, applications of simulation, inventory and queuing problems, advantages and disadvantages, brief Introduction of simulation languages.

V. TEXT BOOKS:

1. J. K. Sharma, “Operations Research”, Macmillan, 5th Edition, 2012.
2. R. Pannerselvan, “Operations Research”, PHI Publications, 2nd Edition, 2006.

VI. REFERENCE BOOKS:

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, “Operations Research”, Pearson Education, 1st Edition, 2013.
2. Maurice Saseini, ArhurYaspan, Lawrence Friedman, “Operations Research: Methods & Problems”, 1st Edition, 2013.
3. Hamdy A. Taha, “Introduction to O.R”, PHI, 8th Edition, 2013.
4. Harvey M.Wagner, “Operations Research”, PHI Publications, 2nd Edition, 2013.

VII. WEB REFERENCES:

1. http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html
2. https://pe.gatech.edu/degrees/online-masters-degrees/operations-research
3. http://nptel.ac.in/courses/112106134/1

VIII. E-TEXT BOOKS:

1. http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf 2_
2. http://www.ggu.ac.in/download/Class-Note14/Operation%20Research07.04.14.pdf

PROJECT MANAGEMENT AND PLANNING

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC30	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Construction project planning and administration the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality and participation satisfaction. Teaching these requirements by the designed course content.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The construction project schedules, documents for planning and management of construction processes.
II. The various types of planning tools like bar chart, CPM networks and PERT analysis
III. The different methods of project delivery, roles and responsibilities of all constituencies involved in the design and construction process.
IV. The various types of construction contracts, their legal aspects and provisions.

III. COURSE OUTCOMES:

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

CO1	Apply the knowledge of management functions like planning, scheduling, executing and controlling of projects for completion of project within given time.	Apply
CO2	Apply the knowledge of network analysis of construction activities and optimize resources by using bar chart, CPM networks.	Apply
CO3	Apply the knowledge of modern construction practices and techniques to achieve quality of work in projects	Apply
CO4	Identify the resource planning and management in construction to improve the performance management and organizational effectiveness.	Apply
CO5	Understand the computer based models adopted in construction industry for optimization of cost and schedule of a project	Understand
CO6	Identify the different types of contracts in construction, arbitration, legal aspects and provision to safe guard the labor and human rights.	Apply

IV. SYLLABUS

MODULE –I: PROJECT MANAGEMENT (09)

Introduction, Project planning, scheduling, controlling, Role of decision in project management, Project management Process and role of Project Manager.

MODULE –II: PROJECT PLANNING TOOLS (09)

Bar Charts and Milestones Chart: Introduction, Development of bar chart, Short comings and remedial measures, Milestone charts.CPM & PERT: Elements of network, Time estimates, frequency distribution, mean, variance and standard deviation, probability distribution. Network Analysis: Slack, Float, Critical path, crashing of activity.

MODULE –III: COST ANALYSIS & UPDATING (09)

Introduction, Projects cost: Direct cost, Indirect cost, slope of direct cost curve, total project cost and optimum duration, cost optimization.

Project Updating: Introduction, updating process, data required for updating, steps in process updating.

MODULE –IV: RISK ANALYSIS AND RESOURCE ALLOCATION (09)

Certainty, risk and uncertainty, risk management, identification and nature of construction risks, contractual allocation of risk, types of risks, minimizing risks and mitigating losses, use of expected values, utility in investment decisions, decision trees, sensitivity analysis. Resource Allocation: Resource usage profiles, Resource smoothing and levelling.

MODULE –V: CONSTRUCTION EQUIPMENT (09)

Types of compaction Equipment's, Types of Excavation and digging Equipment's, Types of hoisting equipment's, Types of Material handling Equipment's and Types of heavy earth moving equipment's.

V. TEXT BOOKS:

1. B. C. Punmia, K.K. Khandelwal, Project Planning and Control with PERT and CPM, Laxmi Publications, 2005.
2. Sharma S.C. "Construction Equipment and Management, Khanna Publishers, New Delhi, 2002.

VI. REFERENCE BOOKS:

1. Peurifoy,R.L, Ledbetter.W.B and schexnayder,C, "Construction Planning and Equipment methods, McGraw Hill, Singapore, 1993.
2. Callahan,M.T., Quackenbush,D.G.,and rowing,J.E., "Construction Project Scheduling, McGraw Hill, New York, 1998.
3. Cleland, D.I. and Ireland, L.R., "Project Management: Strategic Design and Implementation, McGraw Hill, New York, 2002.

VII. WEB REFERENCES:

1. https://nptel.ac.in/courses/105/106/105106149/
2. https://onlinecourses.nptel.ac.in/noc19_mg30/preview

VIII. E-TEXT BOOKS:

https://books.google.co.in/books/about/Project_Management_Planning_and_Control.html?id=BQa8wudi6AAC&redir_esc=y

ENGLISH FOR RESEARCH PAPER WRITING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC01	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

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
III. 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	Apply
CO 2	Examine the way of methods for avoiding plagiarism in research	Understand
CO 3	Apply the feasibility and practicality of research methodology for a proposed project.	Apply
CO 4	Make use of the legal procedure and document for claiming patent of invention.	Apply
CO 5	Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP	Apply

IV. SYLLABUS:
MODULE – I: PLANNING AND PREPARATION (04)
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 (05)
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

MODULE – III: DISCUSSION AND CONCLUSIONS (05)
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 (05)
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 (05)

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:

1. 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.

DISASTER MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC02	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

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.	Understand
CO 2	Understand how to react effectively to natural, manmade, and planetary hazards	Understand
CO 3	Explore the history of the field and comprehend how past events are earthquake, landslides, and volcanic hazards.	Analyze
CO 4	Describe the basic concepts of the emergency management cycle mitigation, preparedness, response, and recovery	Understand
CO 5	Recognizes the stakeholders in disaster management system, their jurisdiction and responsibilities	Remember

IV. SYLLABUS

MODULE – I: INTRODUCTION (04)

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 (05)

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 (05)

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 (05)

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 (05)

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

SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC03	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

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 subjects 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	Understand
CO 2	Formulate simple sentences	Apply
CO 3	Apply order and roots	Apply
CO 4	Understand Ancient Sanskrit literature about science & technology	Understand
CO 5	Develop logical thinking being a logical language in technical concepts	Apply

IV. SYLLUBUS:

MODULE – I: INTRODUCTION (06)

Alphabets in Sanskrit, Past/Present/Future Tense.

MODULE – II: SENTENCES (04)

Simple Sentences

MODULE – III: ROOTS (04)

Order, Introduction of roots

MODULE – IV: SANSKRIT LITERATURE (04)

Technical information about Sanskrit Literature

MODULE – V: TECHNICAL CONCEPTS (06)

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.

VALUE EDUCATION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC04	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 24**		

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	Understand
CO 2	Adopt value-based living and holistic technologies to save nature	Apply
CO 3	Inculcate positive thinking, dignity of labor and religious tolerance	Apply
CO 4	Develop the overall Character and Competence through self-management	Analyze
CO 5	Practice Self-control. Honesty through Studying effectively all religious messages	Apply

IV. SYLLABUS:

MODULE – I: VALUES AND SELF-DEVELOPMENT (04)

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 (06)

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 (06)

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 (04)

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 (04)

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”.

CONSTITUTION OF INDIA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC05	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

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.	Understand
CO 2	Understand the Constitutional Rights and and duties	Understand
CO 3	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary	Understand
CO 4	Analyse the decentralization of power between central, state and local self-government.	Analyze
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy	Apply

IV. SYLLABUS:

MODULE – I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION (08)

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.

MODULE – II: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES (04)

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

MODULE – III: ORGANS OF GOVERNANCE (04)

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 (04)

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 Zila 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 (04)

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

PEDAGOGY STUDIES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC06	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

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	Understand
CO 2	Understand pedagogical practices are being used by teachers in formal and informal classrooms in developing countries	Understand
CO 3	Interpret the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners	Understand
CO 4	Classify the importance of class room practice, curriculum and learning in Professional Development.	Understand
CO 5	Summarize teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	Understand

IV. SYLLABUS:

MODULE – I: INTRODUCTION (04)

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 (04)

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

MODULE – III: PEDAGOGICAL PRACTICES (06)

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 (05)

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 (05)

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.

STRESS MANAGEMENT BY YOGA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC07	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

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: (Same as R18)

CO 1	Understand Ashtanga yog and its impartance	Understand
CO 2	Identify the Dos and Do nots of Life by practicing the Yam and Niyam	Analyze
CO 3	Interpret the Shaucha and its components	Understand
CO 4	Make use of breathing techniques and Asan and Pranayam	Understand
CO 5	Develop healthy mind in a healthy body thus improving social health also	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION (06)

Definitions of Eight parts of yog. (Ashtanga)

MODULE – II: YAM AND NIYAM (04)

Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha.

MODULE – III: SHAUCHA (05)

Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

MODULE – IV: ASAN AND PRANAYAM (05)

Asan and Pranayam. Various yog poses and their benefits for mind & body

MODULE – V: BREATHING TECHNIQUES (04)

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”.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC08	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

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.	Understand
CO 2	Identify day to day work and duties for developing peace and prosperity as depicted in Geeta.	Analyze
CO 3	Formulate the daily life style by depicting the verses from Bhagavatgeetha.	Analyze
CO 4	Outline the verses of Shrimad Bhagavad Geetha for holistic development.	Create
CO 5	Demonstrates personality development by verses of Bhagavatgeetha.	Create

IV. SYLLUBUS:

MODULE – I: HOLISTIC DEVELOPMENT (08)

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 (04)

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 (04)

Shrimad BhagwadGeeta: Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

MODULE – IV: BASIC KNOWLEDGE (04)

Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68. Chapter 12 - Verses 13, 14, 15, 16,17, 18

MODULE – V: ROLE MODEL (04)

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

BUSINESS SUSTAINABILITY MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC09	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course student will be able to learn sustainability management, business sustainability dimensions, paradigms of business sustainability, sustainability management knowledge and methods.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The sustainability challenges and opportunities in the global economy.
II. The design, technology and planning for sustainability.
III. The regulatory environment and international policies for sustainability.
IV. The contemporary paradigms of business sustainability.
V. The design, technology and planning for sustainability management.

III. COURSE OUTCOMES:

After successful completion of the course, students shouldbe able to:

CO 1	Understand sustainability challenges and opportunities in the global economy	Understand
CO 2	explore opportunities for value creation through stakeholder and partner collaboration	Understand
CO 3	Investigate the potential of technology, design, and innovation to enable or limit sustainable business practices.	Understand
CO 4	Understand product sustainability life cycle and management	Understand
CO 5	Develop proactive plans for enhancing sustainability and resilience of Corporate firms.	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO SUSTAINABILITY MANAGEMENT (06)

Definition, nature and characteristics of sustainability management, history of sustainability management, future of sustainability management, sustainability and environmental management, emerging trends in sustainability.

MODULE – II: BUSINESS SUSTAINABILITY DIMENSIONS (04)

Dimensions of Sustainability, Challenges Facing Business, Stakeholders and Stakeholder Management Issues in Sustainability management, sustainability management approaches.

MODULE – III: EMERGING PARADIGMS OF BUSINESS SUSTAINABILITY (06)

Managing sustainability – functional responses, strategy and leadership issues, linkages with External Stakeholders.
Reporting, Measurements and Standards, Emerging Business Issues in Sustainability.

MODULE – IV: PRODUCT SUSTAINABILITY MANAGEMENT (04)

Life Cycle Thinking, Environmental Life Cycle Assessment, Life Cycle Costing Sustainable

Procurement, Supply Chain Sustainability, Product Stewardship, Extended Producer Responsibility.

MODULE – V: SUSTAINABILITY MANAGEMENT KNOWLEDGE AND METHODS (04)

Sustainability Business Modeling and the Circular Economy, Impact measurement and Valuation, Digitalization, Data and Sustainability, Sustainability communication, Corporate sustainability management.

V. TEXT BOOKS:

1. Margaret Robertson, "Dictionary of Sustainability", Routledge, 16th May 2017.
2. Jane Penty, "Product Design and Sustainability Strategies, Tools and Practice", Routledge, 27th August, 2019.
3. John Blewitt, "Understanding Sustainable Development", Routledge, 22nd December 2017.

VI. REFERENCE BOOKS:

1. Margaret Robertson, "Sustainability Principles and Practices", Routledge, 10th February, 2021.
2. RikiTherivel, Graham Wood, "Methods of Environmental and Social Impact Assessment", Routledge, 14th September, 2017.
3. NikoRooda, "Fundamentals of Sustainability Development", Routledge, 30th September, 2020.

VII. WEB REFERENCES:

1. https://www.slideshare.net/PresentationLoad/sustainability-management-ppt-slide-template
2. https://www.slideshare.net/szl/sustainable-development-management
3. https://www.slideshare.net/eccinternational/corporate-sustainability-management

VIII. E-TEXT BOOKS:

1. https://about.jstor.org/librarians/books/sustainability/
2. http://www. ebooktake.in/pdf/title/sustainability management
3. http://all4ryou.blogspot.in/2012/06/becg-sustanability development
4. http://books.google.com/books/about/ corporate sustainability management

BUSINESS ETHICS AND CORPORATE GOVERNANCE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC10	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW

In this course students will be able to learn business ethics, ethical value system, conceptual framework of corporate governance, corporate social responsibility

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Business Ethics and to provide best practices of business ethics codes.
II. The values and implement in their careers to guide beliefs, attitudes, and behaviors.
III. The corporate social responsibilities and practice in practical and professional life.
IV. The ethical issues in corporate governance and to adhere to the ethical.
V. The legal framework to protect the ethical practices of organizations.

III. COURSE OUTCOMES:

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

CO 1	understand the business ethics and explore the relationship between ethics and business and economics across different cultural traditions.	Understand
CO 2	Comprehend the relationship between ethics, morals and values in the workplace.	Understand
CO 3	Analyze and understand various ethical philosophies to explain how they contribute to current management practices.	Analyze
CO 4	Analyze the reasons of systematic failure of corporate governance that could spread from individual firms to entire markets or economies.	Analyze
CO 5	Analyze corporate social Responsibility	Analyze

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO BUSINESS ETHICS (06)

Meaning, Principles of Business Ethics, Characteristics of Ethical Organization, Ethics, Ethics of Corporate Governance, Globalization and Business Ethics, Stakeholders' Protection, Corporate Governance and Business Ethics.

MODULE – II: THE ETHICAL VALUE SYSTEM (04)

Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

MODULE – III: LAW AND ETHICS (06)

Relationship between Law and Ethics, Other Bodies in enforcing Ethical Business Behavior, Impact of Laws on Business Ethics; Social Responsibilities of Business.

Environmental Protection, Fair Trade Practices, Fulfilling all National obligations under various Laws, Safeguarding Health and wellbeing of Customers.

MODULE – IV: CONCEPTUAL FRAMEWORK OF CORPORATE GOVERNANCE (04)
Meaning, Governance vs. Good Corporate Governance, Corporate Governance vs. Corporate Excellence, Insider Trading, Rating Agencies, Benefits of Good Corporate Governance, Corporate Governance Reforms, and Initiatives in India.

MODULE – V: CORPORATE SOCIAL RESPONSIBILITY (04)
Meaning, CSR and Corporate Sustainability, CSR and Business Ethics, CSR and Corporate Governance, Environmental Aspect of CSR, CSR Models.

V. TEXT BOOKS:

1. J. P. Sharma, "Corporate Governance, Business Ethics & CSR", Ane Books Pvt. Ltd., New Delhi.
2. Bhanu Murthy, K. V. and Usha Krishna, "Politics Ethics and Social Responsibilities of Business", Pearson Education, New Delhi.
3. D Geeta Rani & R K Mishra, "Corporate Governance-Theory and Practice", Excel Books, New Delhi

VI. REFERENCE BOOKS:

1. Christine A Mallin, "Corporate Governance (Indian Edition)", Oxford University 46 Press, New Delhi.
2. Bob Tricker, "Corporate Governance-Principles, Policies, and Practice (Indian Edition)", Oxford University Press, New Delhi.
3. Andrew Crane Dirk Matten, "Business Ethics (Indian Edition)", Oxford University Press, New Delhi.

VII. WEB REFERENCES:

1. https:// www.slideshare.net/glory1988/business-ethics-corporate -governance
2. https:// thenthata.web4kurd.net/mypdf/ethics-corporate-governance
3. https:// bookshallcold. link/pdfread/business-ethics-corporate-governance
4. https:// www.gvpce.ac.in/syllabi/corporate social responsibility/

VIII. E-Text Books:

1. https:// books.google.co.in/books/about/business ethics and corporate governance
2. http://www. ebooktake.in/pdf/title/laws and ethics
3. http://all4ryou.blogspot.in/2012/06/becg-business ethics
4. http://books.google.com/books/about/business corporate governance

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 Programme 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 instituted 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 programme?
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 onlyfinal 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, 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 Programmes 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 subject 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 subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject 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 subject 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 subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects 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 subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects 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 subject 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject 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 subject.
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 subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject 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 subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

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 2021-2022 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, Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 70% 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 PG21 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

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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