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 STRUCTURE AND SYLLABI UNDER AUTONOMOUS STATUS

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2016 - 17)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

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 "IARE-R16" 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 2016 - 17)

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 / comprehensive examination / viva / seminars / assignments / 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 programme will be placed in one of the seven 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	Power Electronics and Electrical Drives	Electrical and Electronics Engineering	PE
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	Software Engineering	Information Technology	SE
7	Aerospace Engineering	Aeronautical Engineering	AE

5.0 TYPES OF COURSES

Courses in a programme may be of two kinds: **Core and Elective.**

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 programme 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.

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

There shall be four professional 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.

6.0 SEMESTER STRUCTURE

The institute shall follow semester pattern. An academic year shall consist of a first semester and a second semester and the summer term. Each semester shall be of 23 weeks (Table 2) 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; out of which number of contact days for teaching / practical shall be 75 and 15 days shall be for examination preparation. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic Calendar is declared at the beginning of the academic year as given 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</td><td>4 weeks</td></tr>
<tr><td>THIRD SEMESTER</td><td colspan="2">Project Work Phase - I</td><td>18 weeks</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 s/he pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years. A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

a) A student will be eligible for the award of M.Tech degree on securing a minimum of 5.0/10.0 CGPA.

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

8.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core Courses, Elective Courses, Laboratory Course, Comprehensive Examination, Internship and Project Work. The list of elective courses may include subjects from allied disciplines also.

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 4 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	Elective Courses	3	3
3	MOOC Courses	-	2
4	Laboratory Courses	3	2
5	Seminar and Technical Writing	3	2
6	Comprehensive Examination	-	2
7	Project Work	128	30

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (06) + Professional Electives (04) + Open Electives (02)	06 @ 3 credits + 06 @ 3 credits	36
Total Laboratory Courses (03)	03 @ 2 credits	06
MOOC Courses (02)	02 @ 2 credits	04
Seminar and Technical Writing (01)	1 @ 2 credits	02
Comprehensive Examination (01)	1 @ 2 credits	02
Project Work	1 @ 30 credits	30
TOTAL CREDITS		**80**

9.0 EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIE during the semester, marks are awarded by taking average of two sessional examinations.

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 as given in Table 4. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Technical Seminar and Term Paper.

Table 4: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE Exam (Sessional)	Technical Seminar and Term Paper	
Max. CIA	25	5	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration, consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper:

Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

9.2 Laboratory Course:

9.2.1 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.

9.2.2 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 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self learning and in compliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives.

9.3.1 The proposed MOOC Courses would be additional choices in all the elective groups subject to the availability during the respective semesters and respective departments will declare the list of the courses at the beginning of the semester. Course content for the selected MOOC Courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course will be mentored by faculty members and Assessment and evaluation of the courses shall be done by the department.

9.3.2 There shall be one Mid Sessional Examination (Quiz exam for 30 marks) after 8 weeks of the commencement of the course and semester end evaluation (Descriptive exam for 70 marks) shall be done along with other regular courses.

9.3.3 Two credits will be awarded upon successful completion of each MOOC Course.

9.3.4 Students interested in doing MOOC Courses shall register the course title at their department office at the start of the semester against the courses that are announced by the department.

9.4 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.

9.4.1 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.

9.4.2 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.

9.4.3 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**

9.4.4 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).

9.4.5 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.

9.4.6 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.

9.5 Comprehensive Examination

The comprehensive examination is aimed at assessing the student's understanding of various Foundation, Skill and Core courses studied by the end of II semester and is intended to test the student's grasp of the chosen field of study. The comprehensive examination is an online test evaluated for 100 marks.

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 80% 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 15% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 80% 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.

10.3 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.

10.4 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.

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

10.6 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.

10.7 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 and Technical Writing / Project, if s/he secures

i. Not less than 40% marks for each Laboratory / Seminar and Technical Writing / Project course in the semester end examination,

ii. A minimum of 50% marks for each Laboratory / Seminar and Technical Writing / 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 10 point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
100 - 80	10	S (Superior)
70 – 79	9	A+ (Excellent)
60 – 69	8	A (Very Good)
55 – 59	7	B+ (Good)
50 – 54	6	B (Average)
Below 50	0	F (Fail)
Absent	0	Ab (Absent)
Authorized Break of Study	0	ABS

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.

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

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

14.0 COMPUTATION OF SGPA AND CGPA

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

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

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a students 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	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	O	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus, SGPA = 139 / 20 = 6.95$$

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0

$$Thus,\ CGPA = \frac{20x6.9 + 22x7.8 + 25x5.6 + 26x6.0}{93} = 6.51$$

16.0 PHOTOCOPY / REVALUATION

A student, who seeks the revaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s) within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 GRADUATION REQUIREMENTS

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

17.1 Student shall register and acquire minimum attendance in all courses and secure 80 credits.

17.2 A student who fails to earn 80 credits within four consecutive academic years from the year of his/her admission with a minimum CGPA of 5.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE

Classification of degree will be as follows:

CGPA ≥ 7.5	CGPA ≥ 6.5 and < 7.5	CGPA ≥ 5.5 and < 6.5	CGPA ≥ 5.0 and < 5.5	CGPA < 5.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

a) In case a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the grade sheet.

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

19.0 IMPROVEMENT OF GRADE:

A candidate, after becoming eligible for the award of the degree, may reappear for the final examination in any of the theory courses as and when conducted for the purpose of improving the aggregate and the grade. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the degree.

However, this facility shall not be availed of by a candidate who has taken the Original Degree Certificate. Candidates shall not be permitted to reappear either for CIE in any course or for Semester End Examination (SEE) in laboratory courses (including Project Viva-voce) for the purpose of improvement.

20.0 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.

21.0 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.

22.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

The college shall institute prizes and medals to meritorious students annually on Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

23.0 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.

24.0 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.

25.0 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.

26.0 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 AERONAUTICAL ENGINEERING

(Autonomous)

STRUCTURAL ENGINEERING

COURSE STRUCTURE

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										
BST001	Theory of Elasticity and Plasticity	PC	Core	3	-	-	3	30	70	100
BST002	Advanced Reinforced Concrete Design	PC	Core	3	-	-	3	30	70	100
BST003	Computer Oriented Numerical Methods	PC	Core	3	-	-	3	30	70	100
	Professional Elective – I	PE	Elective	3	-	-	3	30	70	100
	Professional Elective – II	PE	Elective	3	-	-	3	30	70	100
	Open Elective – I	OE	Elective	3	-	-	3	30	70	100
BST301	MOOC-I (Massive Open Online Course)	PE	Elective	-	-	3	2	30	70	100
PRACTICAL										
BST101	Advanced Concrete Laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				**18**	**00**	**06**	**22**	**240**	**560**	**800**

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										
BST004	Structural Dynamics	PC	Core	3	-	-	3	30	70	100
BST005	Finite Element Method	PC	Core	3	-	-	3	30	70	100
BST006	Advanced Steel Design	PC	Core	3	-	-	3	30	70	100
	Professional Elective –III	PE	Elective	3	-	-	3	30	70	100
	Professional Elective –IV	PE	Elective	3	-	-	3	30	70	100
	Open Elective –II	OE	Elective	3	-	-	3	30	70	100
PRACTICAL										
BST102	Advanced CAD Laboratory	PC	Core	-	-	3	2	30	70	100
BST103	Application Development Mini Project Laboratory	-	Core	-	-	3	2	30	70	100
TOTAL				**18**	**00**	**06**	**22**	**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										
BST401	Seminar and Technical Writing	PC	Core	-	-	3	2	30	70	100
BST302	MOOC-II (Massive Open Online Course)	PE	Elective	-	-	3	2	30	70	100
PRACTICAL										
BST501	Comprehensive Examination	-	Core	-	-	-	2	30	70	100
BST601	Project Work (Phase -I)	-	Core	-	-	-	10	100	-	100
TOTAL				**00**	**00**	**06**	**16**	**190**	**210**	**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
BST602	Project Work(Phase -II)	-	Core	-	-	-	20	30	70	100
TOTAL				**00**	**00**	**00**	**20**	**30**	**70**	**100**

PROFESSIONAL ELECTIVES

GROUP 1: ADVANCED STRUCTURAL ANALYSIS

Course Code	Course Title
BST201	Matrix Methods of Structural Analysis
BST202	Experimental Stress Analysis
BST203	Theory and Analysis of Plates and Shells
BST204	Stability of Structures

GROUP 2: ADVANCED CONCRETE TECHNOLOGY

Course Code	Course Title
BST205	Advanced Concrete Technology
BST206	Special Concretes and Concreting Methods
BST207	Pre-stressed Concrete Design
BST208	Precast Concrete Technology

GROUP 3: ADVANCED STRUCTURAL DESIGN

Course Code	Course Title
BST205	Plastic Analysis and Design of Structures
BST206	Earthquake Resistant Design of Buildings
BST207	Design of Tall Buildings
BST208	Elements of Bridge Engineering

GROUP 4: MULTIDISCIPLINARY TECHNOLOGIES

Course Code	Course Title
BST209	Non-destructive Testing and Structural Evaluation
BST210	Rehabilitation and Retrofitting of Structures
BST211	Composite Materials for Structural Engineering
BST212	Green Buildings and Energy Conservation

OPEN ELECTIVES-I

Course Code	Course Title
BST701	Disaster Management*
BPE701	Renewable Energy Systems
BCC701	Automotive Design
BES001	Embedded C
BCS701	Advanced JAVA Programming and Web Services
BAE701	Introduction to Aerospace Engineering
Note: * indicates that subject not offered to the students of Civil Engineering Department.	

OPEN ELECTIVES-II

Course Code	Course Title
BST702	Geo Spatial Techniques*
BPE702	Solar Photo Voltaic Energy Conversion
BCC702	Computer Graphics
BES702	Microcontrollers for Embedded System Design
BCS702	Linux Programming
BCS703	Research Methodology
BAE702	Industrial Aerodynamics and Wind Energy
Note: * indicates that subject not offered to the students of Civil Engineering Department.	

SYLLABI

THEORY OF ELASTICITY AND PLASTICITY

I Semester: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST001	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The Course should enable the students to:

I. Understand the elastic properties of materials and its behavior.
II. Calculate the bending and stress distribution system for polar coordinate system in two dimensional problems.
III. Analysis of stress and strain in three dimensions.
IV. Assess the torsion problems for different cross sections.
V. Determine the yield criterions for elastic problems in bending and torsion.

UNIT-I	INTRODUCTION	Classes: 08

Introduction: Elasticity, notation for forces and stresses, components of stresses, components of strain, Hooks law. Plane stress and plane strain analysis, plane stress, plane strain, differential equations of equilibrium, boundary conditions, compatibility equations, stress function, boundary condition.

UNIT-II	TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES	Classes: 10

Two dimensional problems in rectangular coordinates, solution by polynomials, St. Venant's principle, determination of displacements, bending of simple beams, application of Fourier series for two dimensional problems, gravity loading. Two dimensional problems in polar coordinates, stress distribution symmetrical about an axis, pure bending of curved bars, strain components in polar coordinates, displacements for symmetrical stress distributions, simple symmetric and asymmetric problems, general solution of two dimensional problems in polar coordinates, application of general solution in polar coordinates.

UNIT-III	ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS	Classes: 10

Analysis of stress and strain in three dimensions, principal stresses, stress ellipsoid, director surface, determination of principal stresses, max shear stresses, homogeneous deformation, and principal axes of strain rotation.

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

UNIT-IV	TORSION OF PRISMATICAL BARS	Classes: 09
Torsion of prismatic bars, bars with elliptical cross sections, other elementary solution, membrane analogy, torsion of rectangular bars, solution of torsion problems by energy method, use of soap films in solving torsion problems, hydro dynamical analogies, torsion of shafts, tubes, bars etc. Bending of prismatic bars: Stress function, bending of cantilever, circular cross section, elliptical cross section, rectangular cross section, bending problems by soap film method, displacements.		
UNIT-V	**THEORY OF PLASTICITY**	**Classes: 08**
Theory of Plasticity: Introduction, concepts and assumptions, yield criterions.		
Text Books :		
1. Timeshenko, "Theory of Elasticity", McGraw-Hill Publications, 3 rd edition,1970. 2. J. Chakarbarthy, "Theory of Plasticity, McGraw-Hill Publications. 3. Y. C. Fung, "Theory of Elasticity". 4. Gurucharan Singh, "Theory of Elasticity",		
Reference Books:		
1. Sadhu singh, "Theory of Elasticity", Khanna Publishers. 2. Mendelson, A, "Plasticity: Theory and Applications", Mac Millan and Company, New York.		
E-Text Books:		
https://www.amazon.com/Theory-Elasticity-Goodier-Stephen-Timoshenko/dp/0070642702		

ADVANCED REINFORCED CONCRETE DESIGN

I Semester: ST

Course Code	Category	Classes / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST002	Core	3	-	-	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Practical Classes: Nil			Total Classes: 45			

Objectives:

I. This subject is intended to teach the concept of advanced concrete design.
II. The various advanced concepts to design the structure will be explained in the classes

UNIT-I	BASIC DESIGN CONCEPTS	Classes: 08

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.

UNIT-II	LIMIT ANALYSIS OF R.C. STRUCTURES	Classes: 10

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

UNIT-III	DESIGN OF RIBBED SLABS, FLAT SLABS	Classes: 08

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.

UNIT-IV	DESIGN OF REINFORCED CONCRETE DEEP BEAMS & CORBELS	Classes: 10

Steps of designing deep beams, design by IS 456, checking for local failures, detailing of deep beams, analysis of forces in a corbels, design of procedure of corbels, design of nibs.

UNIT-V	DESIGN OF COMPRESSION MEMBERS	Classes: 09

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

Text Books:

1. Reinforced concrete design by S. Unnikrishna Pillai & Menon, Tata Mc. Graw Hill, 3rd Edition, 2009
2. Advanced Reinforced Concrete Design – P.C. Varghese, Practice Hall, 2008
3. Limit state theory and design of reinforced concrete by Dr. S.R. Karve and Dr. V.L. Shah, Standard publishers, Pune, 3rd Edition, 1994

Reference Books:

1. Reinforced concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
2. Reinforced concrete structural elements – behaviour, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced concrete structures, Vol.1, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2004.
5. Reinforced concrete structures – I.C. Syal & A.K. Goel, S. Chand, 2004.

E-Text Books:

1. http://www.amazon.in/Reinforced-Concrete-Design-Devdas-Menon/dp/007014110X

COMPUTER ORIENTED NUMERICAL METHODS

I Semester : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST003	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Solve linear equations by matrix methods of analysis.
II. Apply interpolation functions and methods to analyze and interpret data.
III. Use finite difference methods to solve differential equations.
IV. Solve differentiation and integration problems numerically.
V. Solve ordinary differential equations by numerical methods.

UNIT-I	SOLUTIONS OF LINEAR EQUATIONS	Classes: 09

Solutions of linear equations: direct method, cramer's rule, gauss elimination method, gauss, jordan elimination, triangulation (lu decomposition) method, jacobi iteration method, gauss-seidel iteration, successive over-relaxation method.
Eigen values and Eigen vectors: Jacobi method for symmetric matrices, given's method for symmetric matrices, householder's method for symmetric matrices.

UNIT-II	INTERPOLATION	Classes: 09

Linear interpolation, higher order interpolation, lagrange interpolation, interpolating polynomials using finites differences, hermite interpolation, piece-wise and spline interpolation.

UNIT-III	FINITE DIFFERENCE METHOD AND APPLICATIONS	Classes: 09

Introduction, differentiation formulas by interpolating parabolas, backward and forward and central differences, derivation of differentiation formulae using taylor series, boundary conditions, beam deflection, solution of characteristic value problems.

Richardson's extrapolation, use of unevenly spaced pivotal points- integration formulae by interpolating parabolas, numerical solution to spatial differential equations.

UNIT-IV	NUMERICAL DIFFERENTIATION AND INTEGRATION	Classes: 09

Numerical differentiation: Difference methods based on undetermined coefficients, optimum choice of step length, partial differentiation,Numerical integration: method based on interpolation, method based on undetermined coefficient, gauss, Lagrange interpolation method, reduced integration method, composite integration method, double integration using trapezoidal and Simpson's method.

UNIT-V	ORDINARY DIFFERENTIAL EQUATION	Classes: 09
ordinary differential equation: Euler's method, backward Euler method, mid-point method, single step method, Taylor's series method, boundary value problems		
Text Books:		
1. M. K. Jain, S. R. K. Iyengar, R. K. Jain, "Numerical methods for scientific and engineering computations", New Age International Publishers, 6th Edition, 2012. 2. S.S.Sastry, "Introductory methods of numerical analysis", Prentice Hall India - PHI Learning, 5th Edition, 2012		
Reference Books:		
1. Curtis F. Gerald, "Applied numerical analysis," Pearson Education, 7th Edition, 2007. 2. E. Kreyzig, "Advanced engineering mathematics," Wiley India Pvt. Ltd., 8th Edition, 2010		
Web References:		
1. nptel.ac.in/courses/105105043/ 2. http://csc.ucdavis.edu/~cmg/compmech/tutorials.htm		
E-Text Books:		
1. http://store.elsevier.com/Computational-Methods-in-Engineering/S_P_-Venkateshan/isbn-9780124167032/ 2. https://epiportal.com/Ebooks/numerical_methods_for_engineers_for_engineers/ 3. ebooks.cambridge.org/ebook.jsf?bid=CBO9780511812200		

ADVANCED CONCRETE LABORATORY

I Semester : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST101	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes:36		

OBJECTIVES:

The course should enable the students to:

I. Upgrade the fluency and acquire a functional knowledge of English Language.
II. Enrich thought process by viewing a problem through multiple angles.

LIST OF EXPERIMENTS

Week-1	**TESTS ON CEMENT**

Evaluation of properties: cement
- Consistency
- Setting times
- Soundness
- Compressive Strength

Week-2	**TESTS ON FINE AGGREGRATES**

Evaluation of properties: Fine aggregates
Bulking of fine Aggregate

Week-3	**TESTS ON COARSE AGGREGRATES**

Evaluation of properties: Coarse aggregates
Shape Tests of Aggregates

Week-4	**AGGREGRATE STRENGTH**

Aggregate Crushing and Impact value

Week-5	**WORKABILITY TEST**

Workability Tests on Fresh self compacting concrete

Week-6	**WORKABILITY VARIATION OF M15 CONCRETE**

Variation of workability with time for M15 grade of concrete – experimental observations.

Week-7	**WORKABILITY VARIATION OF M20 CONCRETE**

Variation of workability with time for M20 grade of concrete – experimental observations.

Week-8	**MARSH CONE TEST**
Marsh cone test	
Week-9	**PERMEABILITY**
Permeability of Concrete	
Week-10	**INFLUENCE OF WATER-CEMENT RATIO**
Influence of Water Cement ratio on workability and Strength of concrete	
Week-11	**ACCELERATED CURING**
Accelerated Curing of Concrete	
Week-12	**NON-DESTRUCTIVE TESTS**
Non-Destructive Testing of Concrete (NDT) using Rebound Hammer and UPV instruments	
Week-13	**PARAMETERS OF NDT**
Influence of following parameters on NDT readings – experimental observations. (i) Aggregate – cement ratio (ii) Water cement ratio	
Week-14	**PARAMETERS OF NDT**
Influence of following parameters on NDT readings – experimental observations. (i) Excess / Deficient cement (i) Aggregate type	
Week-15	**STRAIN AND DEFLECTION OF MEMBER UNDER LOADS**
Strain and deflection measurement for a structural member under single point or two point loading – crack propagation observation	
Reference Book:	
1. Neville. A.M, (1988), Properties of Concrete, English Language Book Society/Longman Publications. 2. Mehta. P.K and Paulo. J.M.M, (1997), Concrete – Microstructure – Properties and Material, McGraw-Hill. 3. Krishna Raju. N., (1985), Design of Concrete Mix, CBS Publications	

EQUIPMENT REQUIRED FOR A BATCH OF 18 STUDENTS:

S.No	Name of the component	Quantity
1	Apparatus for aggregate crushing test (IS 9376-1979)	1
2	Aggregate impact testing machine	1
3	Pycnometer	1
4	Length and elongation gauges(IS 2389)	1
5	Bitumen Penetration Set up	1
6	Ring and ball apparatus (IS 1205)	1
7	Penkey martins apparatus (IS 1448)	1
8	Vicats apparatus (IS 5513)	1

9	Lechatlirers apparatus (IS 5514)	1
10	Slump and compaction factor set up	1
11	Specific gravity bottle 50ml	3
12	Longitudinal compress meter	1
13	Ductility testing machine as per IS:1208	1
14	Los angles abration test machine(IS: 10070)	1
15	Devals Abrasion Test Machine (IS 2346 part IV)	1
16	Compressive testing machine of 200KN capacity	1
17	Vicat apparatus	2
18	Lechatlier's apparatus	3
19	Bulking of fine aggregate	1
20	Aggregate crushing and impact value apparatus	1
21	Workability test on SSC	1
22	Air Entrainment Test	1
23	Marsh cone test	1
24	Permeability of Concrete	1
25	Rebound hammer	1
26	Accelerated Curing Tank	1
27	Vee Bee Consistometer	1
28	Compaction factor test	1
29	Bitumen Extractor	1
30	Benzene 500ml	1
31	Ultra Sonic Pulse Velocity	1
32	J-Ring	1
33	Electric resistance strain meter	1
34	Flexural Testing Equipment for concrete	1
35	Rectangular beam mould for Flexure	1

STRUCTURAL DYNAMICS

II Semester : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST004	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

I. To find the behavior of structures subjected to dynamic loads such as wind, earthquake and blast loads.
II. To study the different dynamic analysis procedures for calculating the response of structures.
III. Evaluate the structural properties, mode shapes for different structures.

UNIT-I	THEORY OF VIBRATIONS	Classes: 09

Theory of vibrations: Introduction, elements of vibratory system, degrees of freedom, continuous system, lumped mass idealization, oscillatory motion, simple harmonic motion, vectorial representation of S.H.M., free vibrations of single degree of freedom system, undamped and damped vibrations, critical damping, logarithmic decrement, forced vibration of SDOF systems, harmonic excitation, dynamic magnification factor, phase angle, bandwidth

UNIT-II	SDOF SYSTEM	Classes: 09

Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis, types of prescribed loading, methods of discretization, formulation of equations of motion by different methods, direct equilibration using newton's law of motion / d'alembert's principle, principle of virtual work and hamilton principle.

Single degree of freedom systems: Formulation and solution of the equation of motion, free vibration response, response to harmonic, periodic, impulsive and general dynamic loadings, duhamel integral.

UNIT-III	MDOF SYSTEM	Classes: 09

Multi Degree of Freedom Systems : Selection of the degrees of freedom, evaluation of structural property matrices, formulation of the MDOF equations of motion, undamped free vibrations.

Solutions of Eigen value problem for natural frequencies and mode shapes, analysis of dynamic response, normal co-ordinates, uncoupled equations of motion, orthogonal properties of normal modes, mode superposition procedure.

UNIT-IV	VIBRATION ANALYSIS	Classes: 09

Practical Vibration Analysis: Introduction, stodola method, fundamental mode analysis, analysis of second and higher modes, holzer method, basic procedure.

Continuous systems: Introduction, flexural vibrations of beams, elementary case, derivation of governing differential equation of motion, analysis of undamped free vibrations of beams in flexure, natural frequencies and mode-shapes of simple beams with different end conditions, principles of application to continuous beams.

UNIT-V	EARTHQUAKE ANALYSIS	Classes: 09

Introduction to Earthquake Analysis: Introduction, excitation by rigid base translation, lumped mass approach - SDOF and MDOF systems - I. S. Code methods of analysis for obtaining response of multi storied buildings.

Text Books:

1. Dynamics of Structures by Clough & Penzien, McGraw Hill, New York
2. Structural Dynamics by Mario Paz, CBS Publishers, New Delhi (2004).
3. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi (2007).
4. IS: 1893 – 1984, "Code of practice for Earthquake resistant design of Structures" and latest IS: 1893 - 2002 (version) Part-1

Reference Books:

1. Dynamics of Structures by J. L. Humar, CRC Press (1990).
2. Wind effects on structures: fundamentals and applications to design by E. Siniu and R. H. Scanlan , John Wiley and Sons (1997).

Web References:

1. http://nptel.ac.in/courses/105101006/
2. http://www-personal.umich.edu/~jerlynch/cee511/

E-Text Books:

http://ebooks.cambridge.org/ebook.jsf?bid=CBO9780511618086

FINITE ELEMENT METHODS

II Semester : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST005	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes : Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

I. The course is intended to teach the basic concepts of finite element analysis.
II. Different methods will be taught in the class and their use will be explained in the class.
III. Calculation of strain and stress matrix.
IV. Analysis procedure and the matrix operations.
V. Know the concepts of ISO-parametric elements.

UNIT-I	INTRODUCTION TO FEM AND PRINCIPLES OF ELASTICITY	Classes: 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

UNIT-II	1D AND 2D FEM	Classes: 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

UNIT-III	DIFFERENT FORMULATIONS AND 3D FEM	Classes: 09

Isoparametric formulation: Concept, different iso-parametric elements for 2D analysis, formulation of 4-noded and 8-noded isoparametric 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 elements-strain, displacement relationship, formulation of hexahedral and isoparametric solid element.

UNIT-IV	ANALYSIS OF PLATES	Classes: 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.

UNIT-V	NON-LINEAR ANALYSIS	Classes: 09
Introduction to non linear analysis: basic methods, application to special structures.		
Text Books:		
1. Finite Element Analysis by C.S. Krishnamoorthy, Tata McGraw Hill Publishing Co. Ltd (1994). 2. Concepts and applications of Finite element analysis by Cook R.D., Malkas D.S. & Plesha M.E, John Wiley & Sons (1999).		
Reference Books:		
1. Finite element Methods by O.C. Zienkiewicz, Robert L. Taylor, J. Z. Zhu, Butterworth-Heinemann Ltd (2013). 2. Introduction to Finite element Method by T.C. Patil and Belugunudu. 3. Introduction to Finite element Method by J.N. Reddy.		
Web References:		
1. http:// nptel.ac.in/courses/105106051/ 2. http:// nptel.ac.in/courses/1051050		
E-Text Books:		
1. http://web.mit.edu/16.810/www/16.810_L4_CAE.pdf		

ADVANCED STEEL DESIGN

II Semester : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST006	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

I. To know how to design and use the different types of steel structural elements.
II. Design of industrial buildings.
III. Design light gauge steel structures.
IV. Design of steel truss girder and steel bunkers

UNIT-I	**SIMPLE CONNECTIONS –RIVETED, BOLTED PINNED AND WELDED CONNECTIONS**	**Classes: 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.

UNIT-II	**ECCENTRIC AND MOMENT CONNECTIONS**	**Classes: 09**

Introduction, beams, column connections, connections subjected to eccentric shear, bolted framed connections, bolted seat connections, bolted bracketed connections. Bolted moment connections, welded framed connections, welded bracket connections, moment resistant connections.

UNIT-III	**ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS**	**Classes: 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.

UNIT-IV	**DESIGN OF STEEL TRUSS GIRDER BRIDGES**	**Classes: 09**

Types of truss bridges, component parts of a truss bridge, economic proportions of trusses, self weight of truss girders, design of bridge compression members, tension members; wind load on truss girder bridges; wind effect on top lateral bracing; bottom lateral bracing; portal bracing; sway bracing.

UNIT-V	**DESIGN OF STEEL BUNKERS AND SILOS**	**Classes: 09**

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

Text Books:

1. Design of Steel Structures. P. Dayaratnam, S. Chand (2012).
2. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientitic Publishes Journals Department.
3. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.

Reference Books:

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

Web References:

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

ADVANCED CAD LABORATORY

II Semester : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST102	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes:36		

OBJECTIVES:

The course should enable the students to:

To impart knowledge on the use of various softwares.

LIST OF EXPERIMENTS

Week-1	**MATRIX ANALYSIS**
Program using arrays and functions for matrix manipulation.	
Week-2	**BMD AND SFD**
Programs to draw bending moment and shear force diagrams using graphic in C	
Week-3	**DESIGN OF SLABS**
Program for design of slabs using Excel	
Week-4	**DESIGN OF BEAMS**
Program for design of beams using Excel	
Week-5	**DESIGN OF BEAMS IN EXCEL**
Program for design of beams using Excel	
Week-6	**DESIGN OF COLUMN AND FOOTING IN EXCEL**
Program for design of column and footing using Excel	
Week-7	**DESIGN OF COLUMN AND FOOTING IN EXCEL**
Program for design of column and footing using Excel	
Week-8	**ANALYSIS OF TRUSS IN STAAD Pro**
Analysis of truss using STAAD Pro.	

Week-9	**ANALYSIS OF TRUSS**
Analysis of multistoried space frame using STAAD Pro.	
Week-10	**ANALYSIS OF MULTISTORIED SPACE FRAME**
Analysis of multistoried space frame using STAAD Pro.	
Week-10	**ANALYSIS OF BRIDGE DECK**
Analysis of Bridge deck slab	
Week-10	**ANALYSIS OF BRIDGE DECK**
Analysis of Bridge deck slab	

Reference Book:

1. Mastering autocad 2016 and Autocad LT 2016, by George Omura , Brian C. Benton
2. Computer Aided Design Laboratory by M.N. Sesha Praksh & Dr. G.S. Servesh - Laxmi Publications.
3. Engineering Graphics by P.J. Sha - S. Chand & Co

MATRIX METHODS OF STRUCTURAL ANALYSIS

Group I: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST201	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

Objectives:

The course should enable the student to:

I. Understand the fundamentals of matrix approach to structural analysis
II. Evaluate the flexibility matrix and the local and global stiffness matrices for a structure
III. Analyze plane frames and beams using the flexibility method of analysis
IV. Analyze plane frames and beams using the stiffness method of analysis
V. Apply the procedures of static condensation and sub-structuring for efficient computing.

UNIT-I	INTRODUCTION TO MATRIX METHODS OF ANALYSIS	Classes: 09

Static indeterminacy and kinematic indeterminacy, degrees of freedom, coordinate system, structure idealization, stiffness and flexibility matrices, element stiffness equations, elements flexibility equations, force - displacement equations for truss, beam and tensional elements. Transformation of coordinates, element stiffness matrix, and load vector, local and global coordinates.

UNIT-II	TECHNIQUES FOR ASSEMBLY OF GLOBAL STIFFNESS MATRIX	Classes: 09

Assembly of stiffness matrix from element stiffness matrix, direct stiffness method, general procedure, bank matrix, semi bandwidth, computer algorithm for assembly by direct stiffness matrix method.

UNIT-III	FLEXIBILITY METHOD OF ANALYSIS	Classes: 09

Analysis of plane truss, continuous beam.

Plane frame and grids by flexibility methods.

UNIT-IV	STIFFNESS METHOD OF ANALYSIS	Classes: 09

Analysis of plane truss, continuous beam, plane frame and grids by stiffness methods.

UNIT-V	STATIC CONDENSATION AND SUB-STRUCTURING	Classes: 09

Special analysis procedures, static condensation and sub structuring, initial and thermal stress.
Shear walls, necessity, structural behavior of large frames with and without shear walls, approximate methods of analysis of shear walls.

Text Books:

Pundit and Gupta "Matrix methods of structural analysis"

Reference Books:

1. Matrix analysis of frames structures by William Weaver J.R and James M.Geve, CBS publications. 1986
2. Advanced structural analysis by Ashok.K.Jain, New Channel Brothers.
3. Structural analysis by C.S.Reddy.
4. Matrix structural analysis by Kanchi.
5. Matrix methods of structural analysis by J.Meek.
6. Structural analysis by Ghali and Neyveli.

Web References:

1. nptel.ac.in/courses/Webcourse-contents/.../Structural%20Analysis/pdf/m2l7.pdf

E-Text Books:

1. https://phindia.com/.../matrix_methods_of_structural_analysis_theory_and_problems

EXPERIMENTAL STRESS ANALYSIS

GROUP I : ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST202	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

Objectives:

The course should enable the student to:

I. Learn the experimental approach to the plane elasticity theory
II. Know the working principle of strain gauges
III. Understand the brittle coating analysis and test procedures.
IV. Know the concepts of photo elasticity
V. Determine the state of stresses using 1D and 2D Photoelasticity

UNIT-I	PLANE ELASTICITY THEORY – EXPERIMENTAL APPROACH	Classes: 09

Introduction, strain equations of transformation, compatibility, stress-strain relations-two dimensional state of stress. The plane-elastic problem, the plane-strain approach, plane stress, airy's stress function-cartesian co-ordinates-two dimensional problems in polar co-ordinates, polar components of stress in terms of airy's stress function, forms. Principles of experimental approach: Merit of experimental analysis introduction, uses of experimental stress analysis-advantages of experimental stress analysis, different methods, simplification of problems.

UNIT-II	STRAIN MEASUREMENT USING STRAIN GAUGES	Classes: 09

Definition of strain and its relation to experimental determinations, properties of strain-gauge systems, types of strain gauges, mechanical and optical strain gauges. Electrical strain gauges, introduction, LVDT, resistance strain gauge , various types , gauge factor, materials for adhesion base, etc.

Strain Rosettes: Introduction, the three element rectangular Rosette, the delta rosette, corrections for transverse strain effects.

UNIT-III	BRITTLE COATING ANALYSIS	Classes: 09

Introduction, coating stresses, failure theories, brittle coating crack pattern, crack detection.

Types of brittle coating, test procedures for brittle coating analysis, calibration procedures, analysis of brittle coating data.

UNIT-IV	PHOTO ELASTICITY	Classes: 09

Theory of photo elasticity: Introduction, temporary double refraction, the stress optic law, effects of stressed model in a polaris cope for various arrangements, fringe sharpening, brewster stress optic law.

UNIT-V	TWO DIMENSIONAL PHOTO ELASTICITY	Classes: 09
Introduction, isochromatic fringe patterns, isoclinic fringe patterns, passage of light through plane polaris cope and circular polaris cope, isoclinic fringe pattern, compensation techniques, calibration methods, separation methods, scaling model to proto type stress- materials for photo - elasticity, properties of photo elastic materials.		
Text Books:		
1. Srinath, L.S., Experimental stress analysis, Tata McGraw Hill Publishing Co., New Delhi.1991 2. Frocht M.M.; Photoelasticity Vol. I & II., John Wiley and Sons, New York. 3. Bechwith, Merangoni & Lienhard,. Mechanical measurements Pearson Education, 2003.		
Reference Books:		
1. Experimental Stress Analysis by J.W.Dally and W.F.Riley 2. Experimental Stress Analysis by Dr. Sadhu Singh 3. Experimental Stress Analysis by Dove and Adams 4. Experimental Stress Analysis- Sadhu Singh		
Web References:		
1. www.nptelvideos.in/2012/12/experimental-stress-analysis.html 2. textofvideo.nptel.iitm.ac.in/112106068		
E-Text Books:		
1 https://apm.iitm.ac.in/smlab/kramesh/book 2 nguyen.hong.hai.free.fr/EBOOKS/.../MECANIQUE/MATERIAUX/.../32666_06.pd		

THEORY AND ANALYSIS OF PLATES AND SHELLS

GROUP I: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST203	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

Objectives:

The course should enable the students to:

I. Formulate and solve the differential equations for bending of thin rectangular and circular plates
II. Understand and apply the theory of large deflections of plates
III. Formulate and solve the differential equations for plates on elastic foundations
IV. Apply the membrane and general theory of bending of thin cylindrical shells
V. Evaluate the buckling criteria in plates by solving the governing equation

UNIT-I	THIN RECTANGULAR PLATES	Classes: 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

UNIT-II	CIRCULAR PLATES	Classes: 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.

UNIT-III	PLATES ON ELASTIC FOUNDATIONS	Classes: 09

Plates on elastic foundations, governing differential equation, deflection of uniformly loaded simply supported rectangular plate.

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

UNIT-IV	SHELLS	Classes: 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.

UNIT-V	BUCKLING OF THIN PLATES	Classes: 09

Buckling of plates: Governing equation for bending of plate under the combined action of in-plane loading and lateral loads, buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate.

Text Books:

1. S. P. Timoshenko and W. W. Krieger, Theory of plates and shells, McGraw Hill, 2nd Ed, 1964.
2. R. Szilard, Theory and Analysis of plates - Classical and Numerical Methods, John Wiley and Sons, 2004.
3. A. Zingoni, Shell structures in Civil and Mechanical Engineering, Thomas Telford, 1997.

Reference Books:

1. S. P. Timoshenko and J. M. Gere, Theory of Elastic stability, Dover Publications, 2nd Ed, 2009.
2. Theory of plates by Chandrasekhar, University Press.
3. Plate analysis by N. K. Bairagi, Khanna Publishers. New Delhi.

Web References:

http://155.207.34.6/files/Timoshenko.pdf

E-Text Books:

http://www.derivativesinvesting.net/article/297943071/download-theory-of-shells-and-plates-ebooks-read-online-theory-of-shells-and-plates-ebooks/

STABILITY OF STRUCTURES

GROUP I: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST204	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

1. Understand the behavior and analysis of columns subjected to eccentric and lateral loads
2. Analyze the elastic buckling of columns and frames for various load cases
3. Analyze the inelastic buckling of columns for various load cases
4. Analyze the thin walled bars of open cross-section for torsional buckling
5. Understand the conditions and phenomenon of lateral buckling in beams and plates

UNIT-I	DIFFERENTIAL EQUATION FOR BEAM COLUMNS	Classes: 10

Beam columns: Differential equations for beam columns, beam columns with concentrated loads, continuous lateral loads, couples, beam columns with built in ends, continuous beams with axial load, application of trigonometrically series, effects of initial curvature on deflections, determination of allowable stresses.

UNIT-II	ELASTIC BUCKLING OF COLUMNS AND FRAMES	Classes: 08

Elastic buckling of bars and frames: Elastic buckling of straight columns, effect of shear stress on buckling, eccentrically and laterally loaded columns, buckling of frames, large deflections of buckled bars, energy methods, buckling of bars on elastic foundations, buckle line of bar with intermediate compressive forces, buckling of bars with change in cross-section, effect of shear force on critical load, built up columns.

UNIT-III	INELASTIC BUCKLING IN COLUMNS	Classes: 09

In elastic buckling: Buckle line of straight bar, double modulus theory, tangent modulus theory, inelastic lateral buckling.

Experiments and design formulae: Experiments on columns, critical stress diagram, empirical formulae for design, and various end conditions.

UNIT-IV	TORSIONAL BUCKLING	Classes: 10

Torsion Buckling: Pure torsion of thin walled bars of open cross section, non-uniform torsion of thin walled bars of open cross section, torsional buckling, buckling by torsion and flexure.

UNIT-V	LATERAL BUCKLING	Classes: 08

Lateral buckling of simply supported beams: beams of rectangular cross-section subjected to pure bending. Buckling of simply supported rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

Text Books:
1. Timshenko and Gere “Theory of elastic stability Timshenko& Gere” - Mc Graw Hill 2. Blunch “Stability of metallic structures” - Mc Graw Hill 3. Chem and Atste “Theory of beam- columns” Vol I - Mc.Graw Hill
Reference Books:
1. Special structural concretes by Rajat Siddique, Galgotia Publications. 2. Design of concrete mixes by N.Krishna Raju, CBS Publications. 3. Concrete: Micro structure by P.K.Mehta, ICI, Chennai.
Web References:
http://www.colorado.edu/engineering/CAS/courses.d/Structures.d/IAST.Lect23.d/IAST.Lect23.pdf
E-Text Books:
http://fsajedi.ir/forum/attachment.php?aid=75

ADVANCED CONCRETE TECHNOLOGY

GROUP II: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST205	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the student to:

I. Understand the constituent materials of concrete and their properties
II. Identify the quality of concrete by performing tests on fresh and hardened concrete
III. Design of the concrete mix for high strength concrete and high performance concrete
IV. Know various types of special concrete and their specific applications
V. Learn the quality control and assurance of concrete mix design

UNIT-I	MATERIALS FORMING CONCRETE	Classes: 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.

UNIT-II	TESTS ON FRESH AND HARDENED CONCRETE	Classes: 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.

UNIT-III	HIGH STRENGTH AND HIGH PERFORMANCE CONCRETES	Classes: 09

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

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

UNIT-IV	SPECIAL CONCRETES	Classes: 09

Self compacting concrete, polymer concrete, fiber reinforced concrete, reactive powder concrete, requirements and guidelines, advantages and applications. Light weight concrete.

UNIT-V	QUALITY CONTROL OF CONCRETE	Classes: 09
Concrete mix design: Quality control, quality assurance, quality audit, mix design method - BIS method, ACI method, DOE method.		
Text Books:		
1. A.M.Neville "Properties of Concrete" - ELBS publications. 2. A.K. Santhakumar "Concrete Technology" - Oxford Press. 3. M.S.Shetty "Concrete Technology" - S.Chand & Co.		
Reference Books:		
1. Rajat Siddique "Special Structural concretes" - Galgotia Publications. 2. N.Krishna Raju "Design of Concrete Mixes" - CBS Publications. 3. P.K.Mehta "Concrete: Micro Structure" - ICI, Chennai.		
Web References:		
http://www.alphace.ac.in/downloads/notes/cv/10cv81.pdf		
E-Text Books:		
http://www.site.iugaza.edu.ps/izreid/files/2010/03/cement-concrete-technology.pdf		

SPECIAL CONCRETES AND CONCRETING METHODS

GROUP II: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST206	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Contact Classes: 45			

OBJECTIVES :

The course should enable the student to:

I. Learn the significance, properties and applications of special concretes and their concreting methods
II. Know the properties and design the mix for light weight concrete, fibre reinforced concrete and polymer concrete
III. Learn the procedures for concreting in cold and hot weathers
IV. Know the uses and applications of further categories of special concretes such as prepacked, vacuum, shotcrete, ferrocement, roller compacted, bacterial and geopolymer
V. Understand the requirements, mix-design, production method and test procedures of self-compacted concrete.

UNIT-I	LIGHT WEIGHT CONCRETE	Classes: 10

Introduction to special concretes, light weight concrete, light weight aggregate concrete, workability and mix procedure

Properties and applicability of aerated concrete, no-fines concrete, high density concrete, sulphur-infiltrated concrete

UNIT-II	FIBRE REINFORCED CONCRETE (FRC) AND POLYMER CONCRETE (PC)	Classes: 08

Introduction to fibre reinforced concrete, types of fibres uses and their parameters, workability, mixing and application, current trends in FRC: Slurry infiltrated fibre concrete, compact reinforced composites, high fibre volume micro-fibre system.

Polymer concretes: Polymer impregnated concrete, polymer cement concrete, polymer concrete, partially impregnated concrete, properties and applications

UNIT-III	COLD WEATHER AND HOT WEATHER CONCRETING METHODS	Classes: 09

Effects of cold weather on concrete, concreting when temperature is above 0^{o}C, methods when temperature is below 0^{o}C after concreting, methods when temperature is below 0^{o}C while concreting.

Hardened concrete subjected to freezing and thawing, concreting methods at sub-zero temperature hot weather concreting, Precautions, Aggregates, Water, Production and Delivery

UNIT-IV	FURTHER TYPES OF SPECIAL CONCRETES	Classes: 10

Process of mixing, specific uses and applications of the following types of concrete:

Prepacked concrete, Vacuum concrete, Gunite or Shotcrete, Ferrocement, Roller compacted concrete, Bacterial concrete, Geopolymer concrete

UNIT-V	SELF-COMPACTING CONCRETE (SCC)	Classes: 08
Materials for SCC, requirements for SCC, workability requirements, production and placing, mix-design. Tests methods for SCC: slump flow test, J-ring test, V-funnel test, L-Box test, U-box test, Full box test, Orimet test, new generation plasticizers for SCC		
Text Books:		
1. M.S.Shetty "Concrete Technology"- S.Chand & Co. 2. Rajat Siddique "Special Structural concretes" - Galgotia Publications. 3. A.K. Santhakumar "Concrete Technology" - Oxford Press.		
Reference Books:		
1. N.Krishna Raju "Design of Concrete Mixes" - CBS Publications. 2. P.K.Mehta "Concrete: Micro Structure" - ICI, Chennai. 3. A.M.Neville "Properties of Concrete" - ELBS publications		
Web References:		
1. http://www.dot.state.mn.us/materials/manuals/concrete		
E-Text Books:		
1. http://www. ebooks.narotama.ac.id/files/.../Chapter%205%20Concrete.pdf 2. http://www .accessengineeringlibrary.com/browse/concrete-microstructure-properties-and-materials-fourth-edition		

PRE-STRESSED CONCRETE DESIGN

Group II: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST207	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

This course should enable the students to:

I. Learn the general principles of prestressed concrete
II. Design of prestressed concrete sections in flexure and shear
III. Evaluate the deflections of prestressed concrete beams
IV. Analyze the transmission of prestress in pretensioned members
V. Perform pre-stress analysis of indeterminate structures

UNIT-I	GENERAL PRINCIPLES OF PRESTRESSED CONCRETE	Classes: 09

Pre–tensioning and post, tensioning , Prestressing by straight, concentric, eccentric, bent and parabolic tendons; Different methods and systems of prestressing like Hoyer system, Freyssinet system, Magnel Blaton system, Lee-Mc call system. Losses of Pre-stress: Loss of prestress in pre-tensioned and post, tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage, bending of member and frictional loss ,Analysis of sections for flexure.

UNIT-II	DESIGN FOR FLEXURE AND SHEAR	Classes: 09

Design of Section for Flexure: Allowable stresses, Elastic design of simple beams having rectangular and ,section for flexure, kern lines, cable profile and cable layout.
Design of Sections for Shear: Shear and principal stresses, Improving shear resistance by different prestressing techniques, horizontal, sloping and vertical prestressing, Analysis of rectangular and I, beam, Design of shear reinforcement, Indian code provisions.

UNIT-III	DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS	Classes: 09

Deflections of prestressed Concrete Beams: Short term deflections of uncracked members–prediction of long-time deflections.

Load deflection curve for a PSC beam, IS code requirements for max. deflections

UNIT-IV	PRESTRESS TRANSMISSION	Classes: 09

Transfer of Prestress in Pretensioned Members: Transmission of prestressing 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 approximate, Guyon and Magnel methods, Anchorage zone reinforcement

UNIT-V	STATICALLY INDETERMINATE STRUCTURES	Classes: 09
Statically Indeterminate Structures: Advantages & disadvantages of continuous PSC beams ,Primary and secondary moments, P and C lines, Linear transformation concordant and non-concordant cable profiles ,Analysis of continuous beams and simple portal frames (single bay and single story)		
Text Books:		
1 Krishna Raju.N, "Pre stressed Concrete", Third Edition, Tata McGraw Hill Co., 2010.		
Reference Books:		
1. T. Y. Lin and Burn, "Design of prestress concrete structures", John Wiley, New York, 2011. 2. S. Ramamrutham, "Prestressed concrete" Dhanpat Rai and Sons, Delhi, 2007.		
Web References:		
http://www.pci.org/uploadedFiles/Siteroot/Design_Resources/.../PCI_DWP_binder.pdf		
E-Text Books:		
http://ebooks.cambridge.org/ebook.jsf?bid=CBO9780511997372		

PRECAST CONCRETE TECHNOLOGY

Group II: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST208	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

This course should enable the student to:

I. Understand principle & production of prefabricated
II. Know various structural Components, appreciate modular construction & industrialized construction
III. Design prefabricated elements
IV. have the knowledge of joints & design of expansion joint
V. learn the code provision, importance of avoiding abnormal loads

UNIT-I	INTRODUCTION	Classes: 10

Need for prefabrication, principles, materials, modular coordination, standardization, systems, production, transportation, erection.

UNIT-II	PREFABRICATED COMPONENTS	Classes: 08

Behavior of structural components, large panel constructions, construction of roof and floor slabs, wall panels, columns, shear walls.

UNIT-III	DESIGN PRINCIPLES	Classes: 09

Disuniting of structures, design of cross section based on efficiency of material used.

Problems in design because of joint flexibility, allowance for joint deformation.

UNIT-IV	JOINT IN STRUCTURAL MEMBERS	Classes: 10

Joints for different structural connections, dimensions and detailing, design of expansion joints.

UNIT-V	DESIGN FOR ABNORMAL LOADS	Classes: 08

Progressive collapse, code provisions, equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., importance of avoidance of progressive collapse.

Text Books:

1. K.S. Elliot, "Prestressed concrete structures", Paperback, 1st Edition, 2002.
2. P. Dayaratnam, "Prestressed concrete structures," Oxford Publishing, 1996

Reference Books:

1. Koncz T., "Manual of precast concrete construction, Vols. I, II and III", Bauverlag, GMBH,1971.
2. CBRI, "Building materials and components", India, 1990
3. Betor Verlag ,"Structural design manual, precast concrete connection details, society for the studies in the use of precast concrete", Netherland, 1978.

Web References:

1. http://www.pci.org/uploadedFiles/Siteroot/Design_resources/building_engineering_resources/_related_content/PCI_DWP_binder.pdf
2. http://aksa.lt/senas/en/images/Aksa_katalogai/AKSA%20reference%20list.pdf
3. http://precast.org/wp-content/uploads/2011/05/The-Little-Green-Book-of-Concrete.pdf

E-Text Books:

1. https://books.google.co.in/books/about/Precast_Concrete_Structures.html?id=cOq73lRgm8MC
2. https://books.google.co.in/books?id=htoZefR3TCcC&source=gbs_book_similarbooks

PLASTIC ANALYSIS AND DESIGN OF STRUCTURES

Group 3: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST205	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES :

The course should enable the student to:

I. Analyze the structure using different methods.
II. Understand the design of continuous beams.
III. Understand the influence of different forces on structural members.
IV. Design the connections.

UNIT-I	ANALYSIS OF STRUCTURES	Classes: 10

Analysis of structures for ultimate load: Fundamental principles, static method of analysis, mechanism method of analysis, method of analysis, moment check, carry over factor, moment balancing method.

UNIT-II	CONTINUOUS BEAMS	Classes: 08

Design of continuous beams: Continuous beams of uniform section throughout, continuous beams with different cross-sections.

UNIT-III	INFLUENCE OF DIFFERENT FORCES ON STRUCTURAL MEMBERS	Classes: 09

Secondary design problems: Introduction, influence of axial force on the plastic moment.

Influence of shear force, local buckling of flanges and webs, lateral buckling, column stability.

UNIT-IV	DESIGN OF CONNECTIONS	Classes: 10

Introduction, requirement for connections, straight corner connections, haunched connection, interior beam, column connections.

UNIT-V	DESIGN OF STEEL FRAMES	Classes: 08

Introduction, single span frames, simplified procedures for sinole span frames, design of gable frames with launched connection. Ultimate deflections: Introduction, deflection at ultimate load, deflection at working load, deflections of beams and sinole span frames.

Text Books:

1. M. Wong, “Plastic analysis and design of steel structures”, Butterworth-Heinemann, 2008.
2. L. S. Beedle, “Plastic design of steel frames”, John Wiley & Sons Inc 1958-12, 1958.
3. B. G. Neal, “The plastic methods of structural analysis”, Springer US, 1956.

Web References:

http://www.engr.uky.edu/~gebland/CE%20382/CE%20382%20PDF%20Lecture%20Slides/CE%20382%20L12%20-%20Plastic%20Analysis.pdf

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

Group III: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST206	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

COURSE OBJECTIVES:

After completion of this course, the student shall be able to

1. Analyze the Structures to resist earthquake forces by different methods.
2. Design the various structural elements resisting earthquake forces as per IS Codes.
3. Practice ductile detailing of reinforced concrete and masonry wall building as per codal provisions.

UNIT-I	**Earthquake Ground Motion and Structural Dynamics**	**Classes: 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.

UNIT-II	**Concepts of Earthquake Resistant Design of RCC Structures**	**Classes: 09**

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

UNIT-III	**Seismic Analysis and Modeling of RCC Structures**	**Classes: 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.

UNIT-IV	**Earthquake Resistant Design of RCC Structures**	**Classes: 09**

Ductility considerations, earthquake resistant design of multi-storey RCC buildings and shear walls based on IS 13920 code, capacity based design.

UNIT-V	Earthquake Resistant Design of Masonry Structures	Classes: 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-storey masonry buildings.

Text Books:

1. Earthquake resistant design of structures – S. K. Duggal, Oxford University Press
2. Earthquake resistant design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
3. Seismic design of reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons.

Reference Books:

1. Anil K. Chopra, Dynamics of structures – theory and applications to earthquake engineering, Second Edition, Prentice-Hall India Pvt Ltd.
2. Masory and timber structures including earthquake resistant design –Anand S.Arya, Nem chand & Bros
3. Earthquake –Resistant design of masonry building –Miha Tomazevic, Imperial college Press.
4. Earthquake tips – Learning earthquake design and construction C.V.R. Murty

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

DESIGN OF TALL BUILDINGS

Group III: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST207	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES :

This course should enable the student to:

I. Understand the problems associated with large heights of structures with respect to loads.
II. Know the rudimentary principles of designing tall buildings.
III. Understand loading on various structural systems and corresponding approaches.
IV. Analyze bearing walls, the cross-wall, long-wall and rigid frame structures.
V. To design of rigid frame buildings, shear wall, vierendeel structure and hollow tube structures.

UNIT-I	INTRODUCTION TO TALL BUILDINGS	Classes: 08

The tall building in the urban context, the tall building and its support structure, development of high rise building structures, general planning considerations. Dead loads, live loads, construction loads, snow, rain, and ice loads, wind loads, seismic loading, water and earth pressure loads, loads due to restrained volume changes of material, impact and dynamic loads, blast loads, combination of loads.

UNIT-II	THE VERTICAL STRUCTURE PLANE	Classes: 10

Dispersion of vertical forces, dispersion of lateral forces, optimum ground level space, shear Wall arrangement, behavior of shear walls under lateral loading. The floor structure or horizontal building plane floor framing systems, horizontal bracing, composite floor Systems the high - rise building as related to assemblage kits skeleton frame systems, load bearing wall panel systems, panel frame systems - multistory box systems.

UNIT-III	COMMON HIGH-RISE BUILDING STRUCTURES	Classes: 09

The bearing wall structure, the shear core structure, rigid frame systems, the wall, beam structure: Interspatial and staggered truss systems, frame, shear wall building systems, flat slab building structures, shear truss.

Frame interaction system with rigid, belt trusses, tubular systems, composite buildings, comparison of high rise structural systems other design approaches controlling building drift efficient building forms, the counteracting force or dynamic response.

UNIT-IV	APPROXIMATE ANALYSIS AND DESIGN OF BUILDINGS	Classes: 10

Approximate analysis of bearing wall buildings the cross wall structure, the long wall structure the rigid frame structure approximate analysis for vertical loading, approximate analysis for lateral loading, approximate design of rigid frame buildings, lateral deformation of rigid frame buildings the rigid frame, shear wall structure, the vierendeel structure ,the hollow tube structure.

UNIT-V	OTHER HIGH-RISE BUILDING STRUCTURE	Classes: 08

Deep, beam systems, high, rise suspension systems, pneumatic high, rise buildings, space frame applied to high, rise buildings, capsule Architecture.

Text Books:

1. W. Schueller, "High-rise building structures," John Wiley and Sons, New York, 1976
2. B. S. Smith and A. Coull, "Tall building structures - Analysis and Design," John Wiley and Sons, Inc., 1991.

Reference Books:

1. T. Y. Lin, B. D. Stotes, "Structural Concepts and Systems for Architects and Engineers," John Wiley Publications, 2nd Edition, 1994.
2. L. S. Beedle, "Advances in Tall Buildings," CBS Publishers and Distributors, Delhi, 3rd Edition, 1996.
3. B. S. Taranath, "Structural Analysis and Design of Tall Buildings," Mc Graw Hill, 2nd Edition, 1998.

Web References:

1. http://www.ct.upt.ro/suscos/files/2013-2015/2C08/L13_tall_buildings.pdf
2. http://www-civ.eng.cam.ac.uk/cjb/schools/buildings1/index.html

E-Text Books:

1. https://www.scribd.com/.../Analysis-and-Design-of-Tall-Buildings-Bungale-S-Tarana
2. https://books.google.com/books?isbn=1439804818
3. http://allaboutfreebooks.com/tag/tall-building-design

ELEMENTS OF BRIDGE ENGINEERING

Group III: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST208	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES :

This course should enable the student to:

I. To develop an understanding of and appreciation for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.
II. Develop an intuitive feeling about the sizing of bridge elements, ie. Develop a clear understanding of conceptual design.
III. To understand the load flow mechanism and identify loads on bridges.
IV. To carry out a design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements.
V. To recognize & design block piers and abutments.

UNIT-I	CONCRETE BRIDGES	Classes: 10

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

UNIT-II	SOLID SLAB, GIRDER BRIDGES & CONTINUOUS BRIDGES	Classes: 08

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.

UNIT-III	PRE-STRESSED CONCRETE BRIDGES: FUNDAMENTALS	Classes: 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.

UNIT-IV	PRE-STRESSED CONCRETE BRIDGES: DESIGN	Classes: 10
Condition of first crack, ultimate load design, shear, vertical prestressing, diagonal tension in i-section,end block, magnel's method, empirical method general design requirements, mild steel reinforcement in prestressed concrete member, concrete cover and spacing of pre-stressing steel, slender beams, composite section, propped, design of propped composite section, un propped composite section, two stage prestressing, shrinking stresses, general design requirements for road bridges.		
UNIT-V	**ANALYSIS OF BRIDGE DECKS AND SUB-STRUCTURES**	**Classes: 08**
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.		

Text Books:

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

Reference Books:

1. M.J. Ryall, G.A.R Parke, J.E. Harding, "The Manual of bridge engineering", Thomas Telford Publishers.
2. R. Rajagopalan, "Bridge superstructure", Tata McGraw- Hills Publishing Company Limited.
3. S. Ponnuswamy , "Bridge engineering", Tata McGraw - Hills Publishing Company Limited.

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

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

NON-DESTRUCTIVE TESTING AND EVALUATION OF STRUCTURES

Group IV: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST209	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I. Understand the importance, need, techniques and applicability of Non-destructive Testing (NDT)
II. Learn the NDT methods for surface hardness testing and reinforcement detection.
III. Learn the procedures for corrosion activity and permeability detection in concrete
IV. Understand the procedures, scope and application of various ultrasonic testing methods
V. Understand the methods to detect voids, defection and moisture in concrete.

UNIT-I	INTRODUCTION TO NON-DESTRUCTIVE TESTING (NDT)	Classes: 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 Equipments required, procedure, reporting, applications and limitations.

UNIT-II	SURFACE HARDNESS TESTING AND REINFORCEMENT DETECTION	Classes: 09

Schmidt rebound hammer test: Equipment required, general procedure, applications, scope and limitations.Penetration resistance or windsor robe test: equipment, procedure, applications, scope and limitations.Electromagnetic testing for reinforcement detection: Equipment, procedure, applications, scope and limitations.

UNIT-III	CORROSION ACTIVITY AND PERMEABILITY TESTS	Classes: 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.

UNIT-IV	ULTRASONIC TESTING	Classes: 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.

UNIT-V	VOIDS, DEFECTS AND MOISTURE DETECTION	Classes: 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.		
Text Books:		
1. J Prasad, C. G. K. Nair, "Non destructive testing and evaluation of material," Mcgraw-Hill Education India Pvt.Ltd, 2011.		
Reference Books:		
1. "Guidebook on non-destructive testing of concrete structures," Training course series no. 17, International Atomic Energy Agency, Vienna, 2002 (available online) 2. D. E. Bray and R. K. Stanley, "Nondestructive evaluation: A tool for design, manufacturing and service," CRC Press, 1996.		
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/		
E-Text Books:		
http://www-pub.iaea.org/mtcd/publications/pdf/tcs-17_web.pdf		

REHABILITATION AND RETROFITTING OF STRUCTURES

Group IV: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST210	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the student to:

I. Understand the causes and prevention of deterioration and distress in structures
II. Learn and understand the damage mechanisms in fresh and hardened concrete
III. Understand the methods of inspection and testing of concrete
IV. Learn the methods of repair and retrofitting of structures
V. Know about the techniques of health monitoring of structures

UNIT-I	DETERIORATION AND DISTRESS IN STRUCTURES	Classes: 06

Introduction, definitions of repair, renovation, restoration, rehabilitation and retrofitting. General understanding of deterioration and distress in structures, causes and prevention.

UNIT-II	DAMAGE MECHANISMS IN CONCRETE	Classes: 12

Types of damage and the mechanisms of damage (a) in handling fresh concrete and (b) in hardened concrete. Causes and prevention. Corrosion of steel reinforcement: Mechanism, causes and prevention.

UNIT-III	INSPECTION AND TESTING OF CONCRETE	Classes: 09

Inspection and testing, symptoms and diagnosis of distress.

Damage assessment, NDT.

UNIT-IV	REPAIR AND RETROFITTING OF STRUCTURES	Classes: 10

Repair of structure, common types of repair in concrete structures, repairs in under water structures, gunite, shotcreate, underpinning. Strengthening of structures: Strengthening methods, retrofitting, jacketing.

UNIT-V	HEALTH MONITORING OF STRUCTURES	Classes: 08

Health monitoring of structures, use of sensors, building instrumentation.

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

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

Web References:

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

E-Text Books:

1. https://www.amazon.in/REPAIR-REHABILITATION-CONCRETE-STRUCTURES-POONAM-ebook/dp/B01CVPPWRW
2. https://www.amazon.in/Concrete-Structures-Protection-Repair-Rehabilitation-ebook/dp/B002ZJSVJ6

COMPOSITE MATERIALS FOR STRUCTURAL ENGINEERING

Group IV: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST211	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the student to:

I. Learn the use of composite materials in structures
II. Understand the macro mechanical properties of composite laminae
III. Study the mechanical behavior of glass fibre-reinforced laminates
IV. Understand the use of glass reinforced plastics (GRPs) in structural stiffening
V. Design and analyze the behavior of GRP box beams

UNIT-I	COMPOSITE MATERIALS	Classes: 10

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

UNIT-II	MACRO MECHANICAL PROPERTIES OF COMPOSITE LAMINAE	Classes: 08

Introduction, assumptions and idealizations, stress strain relationships for composite laminae, isotropic, orthotropic laminae, strength characteristics, basic concepts, strength hypothesis for isotropic and orthotropic laminae. Macro mechanical analysis of composite laminae: Introduction, assumptions and limitations, stiffness characteristics of glass reinforced laminae, stress- strain relationships in continuous, discontinuous fibre laminae, strength characteristics of glass reinforced laminae, strengths in continuous, discontinuous fibre laminae.

UNIT-III	BEHAVIOUR OF GLASS FIBRE-REINFORCED LAMINATES	Classes: 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.

UNIT-IV	GRP PROPERTIES RELEVANT TO STRUCTURAL DESIGN	Classes: 10
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.		
UNIT-V	**DESIGN OF GRP BOX BEAMS**	**Classes: 08**
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.		

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, Ori Ishai, "Engineering mechanics of composite materials", Oxford University Press Volume 13,2006

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.

Web References:

1. http://web.iitd.ac.in/~chariarv/Macro_Mech_Analysis.pdf
2. http://nptel.ac.in/courses/112104168/L14.pdf

E-Text Books:

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

GREEN BUILDINGS AND ENERGY CONSERVATION

Group 4: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST212	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorials: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES :

This course should enable the student to:

I. Understand primary components of a sustainable engineering system
II. Know engineering principles for design and construction of green structures
III. Learn about Green Building specifications, and various eco friendly materials
IV. Understand future scope of green buildings

UNIT-I	INTRODUCTION TO GREEN BUILDINGS	Classes: 10

Introduction to high-performance green buildings impacts of building construction, operation, and disposal. Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental implications. Embodied energy in building Materials: Transportation energy for building materials; Maintenance energy for buildings.

UNIT-II	IMPLICATIONS OF BUILDING TECHNOLOGIES	Classes: 08

Implications of building technologies embodied energy of buildings: Framed construction, masonry construction. Resources for building materials, alternative concepts. Recycling of industrial and buildings wastes. Biomass resources for buildings.

UNIT-III	COMFORTS IN BUILDING	Classes: 09

Comforts in building: Green building specifications, thermal comfort in buildings, issues; Heat transfer characteristic of building materials and building techniques.

Incidence of solar heat on buildings, implications of geographical locations.

UNIT-IV	SOLAR ENERGY IN GREEN BUILDINGS	Classes: 08

Utility of solar energy in buildings concepts of solar passive cooling and heating of buildings. Low energy cooling. Case studies of solar passive cooled and heated buildings.

UNIT-V	GREEN COMPOSITES FOR BUILDINGS	Classes: 10

Green composites for buildings: Concepts of green composites. Water utilization in buildings, low energy approaches to water management. Management of solid wastes. Management of sullage water and sewage. Urban environment and green buildings. Green cover and built environment. Future directions in green high performance building technologies.

Text Books:

1. K.S.Jagadish, B.U.Venkataramareddy and K.S.Nanjundarao "Alternative building materials and technologies". New Age International, 2007.
2. " Low energy cooling for sustainable buildings",John Wiley and Sons Ltd, 2009.

Reference Books:

1. Osman Attmann," Green architecture advanced technologies and materials". McGraw Hill, 2010.
2. Michael F. Ashby "Materials and the environment", Elsevier, 2009.
3. Jerry Yudelson, "Green building through integrated design". McGraw Hill, 2009.
4. Mili M. Ajumdar (Ed)," Energy efficient building in India". Teri and Mnes, 2001/2002.

Web References:

1. https://www.buildinggreen.com/
2. http://www.eccostructure.com

E-Text Books:

1. Kibert, C. J. "Sustainable Construction: Green Building Design and Delivery," Third Edition, New York: John Wiley & Sons, Inc., 2012
2. http://www.HPBmagazine.com
3. http://www.igbc.com

DISASTER MANAGEMENT

Open Elective I : AE / (CAD/CAM) / CSE / ES / SE /PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The student should enable the students to:

I. Exposure to disasters, their significance and types.
II. Understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
III. Explore on Disaster Risk Reduction (DRR) approaches.
IV. Enhance awareness of institutional processes in the country.
V. Develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live,with due sensitivity.

UNIT-I	INTRODUCTION TO NATURAL AND MANMADE DISASTERS	Classes: 09

Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT-II	DISASTER, DIFFERENTIAL IMPACTS, CYCLONES AND FLOODS	Classes: 09

Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc. Differential Impacts in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.
Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT-III	APPROACHES TO DISASTER RISK REDUCTION	Classes: 09

Disaster cycle, its analysis, phases, culture of safety, prevention, mitigation and preparedness community based Disaster risk reduction.

Structural, nonstructural sources, roles and responsibilities of community, Panchayati raj Institutions, Urban local bodies, states, centre and other stake holders.

UNIT-IV	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	Classes: 09

Factors affecting vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V	DISASTER RISK MANAGEMENT IN INDIA	Classes: 09

Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation).
Field work and case Studies to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the institute is located.

Text Books:

1. Nick, "Disaster Management: A Disaster Manager's Handbook", Asian Development Bank, Manila Philippines, 1991.
2. Kapur, et al., "Disasters in India: Studies of Grim Reality", Rawat Publishers, Jaipur, 2005.
3. Pelling Mark, "The Vulnerability of Cities: Natural Disaster and Social Resilience", Earthscan Publishers, London, 2003.

Reference Books:

1. Sharma, V. K. (1999), "Disaster Management", National Centre for Disaster Management, IIPE, Delhi, 1999.
2. Anil, K. Gupta and Sreeja, S. Nair (2011), "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.

Web References:

1. http://humanityroad.org/
2. http://www.wcpt.org/disaster-management/what-is-disaster-management
3. http://www.ndmindia.nic.in/
4. http://nidm.gov.in/default.asp
5. http://www.unisdr.org/2005/mdgs-drr/national-reports/India-report.pdf

E-Text Books:

1. http://www.ekalavvya.com/disaster-management-in-india-volume-i-free-ebook/
2. http://cbse.nic.in/natural%20hazards%20&%20disaster%20management.pdf
3. http://www.undp.org/content/dam/india/docs/disaster_management_in_india.pdf
4. http://www.digitalbookindex.org/_search/search010emergencydisastera.asp

RENEWABLE ENERGY SYSTEMS

Open Elective I : AE / (CAD / CAM) / CSE / ES / SE / ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPE701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

This course should enable the students to:

I. Illustrate the concept of photo voltaic power generation.
II. Discuss the Magneto hydrodynamic (MHD) and wind energy power conversion systems.
III. Explain tidal and wave energy.
IV. Design energy conversion systems with low impact on environment.
V. Understand the technology of fuel cells.

UNIT-I	PHOTOVOLTAIC POWER GENERATION SYSTEMS	Classes: 09

Photo voltaic power generation: spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

UNIT-II	MHD WIND ENERGY CONVERSION AND WIND POWER GENERATION	Classes:10

Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology; Wind Energy conversion: Power from wind, properties of air and wind, types of wind turbines, operating characteristics.

UNIT-III	TIDAL AND WAVE ENERGY CONVERSION	Classes:08

Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.

Wave energy conversion: Properties of waves, power content, vertex motion of waves, device applications, types of ocean thermal energy conversion systems application of OTEC systems examples.

UNIT-IV	ENERGY CONVERSION SYSTEMS AND ENVIRONMENTAL EFFECTS	Classes:09

Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, co generation and energy storage, combined cycle co generation, energy storage; Global energy position and environmental effects: energy units, global energy position.

UNIT-V	FUEL CELLS	Classes:09

Fuel cells: Types of fuel cells, H_2O_2 Fuel cells, application of fuel cells, batteries, description of batteries, battery application for large power, environmental effects of energy conversion systems.

Text Books:

1. Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 1990.
2. Rakosh das Begamudre, "Energy conversion systems", New age International publishers, New Delhi - 2000.
3. Freris L.L. Prentice Hall1, "Wind energy Conversion Systems", 1990.
4. Spera D.A., "Wind Turbine Technology: Fundamental concepts of wind turbine technology", ASME Press, NY, 1994.

Reference Books:

1. Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 1997.
2. Ramesh R, Kurnar K.U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 1997.
3. John Twidell, Tony Weir "Renewable Energy Resources", 2nd edition.
4. Kreith, Kreider, "Solar Energy Handbook", McGrawHill

Web References:

1. http://www.nrel.gov/docs/fy13osti/54909.pdf
2. http://www.gisday.com/resources/ebooks/renewable-energy.pdf
3. http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/Renewable-Energy-Potential-for-India.pdf
4. http://www.cerien.upc.edu/jornades/jiie2005/ponencies/power%20converters%20and%20control%20of%20renewable%20energy%20systems%20paper.pdf
5. https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-SOLAR_PV.pdf

E-Text Books:

1. http://maxwell.sze.hu/~marcsa/MegujuloEnergiaforrasok/Books/renewable%20energy%20resources.pdf
2. http://lab.fs.uni-.si/kes/erasmus/Renewable%20Energy%20Conversion,%20Transmission,%20and%20Storage.pdf
3. http://www.landartgenerator.org/LAGI-FieldGuideRenewableEnergy-ed1.pdf

AUTOMOTIVE DESIGN

Open Elective I : AE / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCC701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand and Specify automotive styling and design principles of automotive exteriors.
II. Analyze automotive exterior design trends.
III. Design automotive exteriors using manual and digital renderings.
IV. Create clay models of automotive exterior design.

UNIT-I	AUTOMOTIVE DESIGN TERMINOLOGY , CLASSIFICATION OF CARS BASED ON BODY STYLE	Classes: 09

Overview, Automotive design terminology, automotive design process and factors influencing automotive design, development and history behind different body styles, micro cars, hatchback and it sub types, sedan and its sub-types, coupe and its variants, convertible and its variants, station wagon, sports utility vehicles, multi utility vehicles.

UNIT-II	PLATFORM TECHNOLOGY, TYPES OF CHASSIS, AND AUTOMOTIVE PACKAGING	Classes: 09

Platform technology, types of chassis, and automotive packaging: Definition, motivation, versions of platform, benefits of platform sharing and downside of platform technology; History of automotive chassis, composite construction, unibody construction, tubular space frame, glass-fibre monocoque chassis, aluminium monocoque construction, carbon fibre monocoque construction, ULSAB type, definition and different layout sectors in packaging, Interior dimensions, exterior dimensions, front end (engine compartment), rear end (luggage space), under-body, major factors influencing automotive packaging, regulatory requirements.

UNIT-III	AUTOMOTIVE FRONT- REAR END DESIGN	Classes: 09

Factors affecting the front end design, front end design for better air cooling, latest design trends, bumper design theme, regulation for bumper design.

Evolution of grille design, grille design as a new brand image, hood design and new trends in exterior design, tail lamp, spoiler, bumper design, overall rear design for aerodynamics.

UNIT-IV	AUTOMOTIVE LIGHTING SYSTEM , AUTOMOTIVE GLASSES	Classes: 09

History and development in automotive lighting, different types of optical system, light sources used in lighting, headlamp design and styling, advanced lighting technology, pedestrian friendly lights, signal lamps, latest trends in automotive lighting, different types of automotive glasses, recent development in automotive glass design, importance of glass in car design, role of glazing for car safety, developments in automotive glass design.

UNIT-V	AUTOMOTIVE EXTERIOR DESIGN, PAINTING , SURFACE PROTECTION	Classes: 09

Design methodology, image boards: lifestyle board, mood board, theme board, design trends, design movements, application of design principles, product aesthetics, different types of corrosion on automotive bodies, corrosion protection methods, automotive body painting procedure, paint components and latest trends in automotive body colors.

Text Books:

1. J.Fenton, "Handbook of Automotive Body and System Design", Professional Engineering Publishing, 1st Edition, 2000.
2. Erik Eckermann, "World History of the Automobile", SAE International, 1st Edition, 2002.

Reference Books:

1. Stephen Newbury, "Car Design Year Book 1 to 5", Marrell, 1st Edition, London, 2007.
2. Tony Lewin, "How to Design Car Like A Pro", Motorbooks International, 1st Edition, 2003

Web References:

1. www.carbodydesign.com
2. www.style4cars.com
3. www.cardesignnews.com

E-Text Books:

1. http://www.sciencedirect.com/science/book/9780750656924
2. http://books.sae.org/r-312/

EMBEDDED C

Open Elective I: AE / (CAD / CAM) / CSE / SE / ST /PEED | **I Semester:** ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES001	Core/Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand embedded C and use it for programming embedded system.
II. Apply techniques for data transfer between I/O ports and memory.
III. Apply object oriented programming for designing embedded system.
IV. Use timers to generate time delays.

UNIT-I	PROGRAMMING EMBEDDED SYSTEMS IN C	Classes: 09

Introduction, what is an embedded system, which processor should you use, which programming language should you use, which operating system should you use, how do you develop embedded software, conclusions; Introduction, what's in a name, the external interface of the standard 8051, reset requirements, clock frequency and performance, memory issues, I/O pins, timers, interrupts, serial interface, power consumption, conclusions.

UNIT-II	SWITCHES	Classes: 09

Introduction, basic techniques for reading from port pins; Example: Reading and writing bytes, example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), example: counting goats, conclusions.

UNIT-III	ADDING STRUCTURE TO THE CODE	Classes: 09

Introduction, object oriented programming with C, the project header (MAIN.H), the port header (PORT.H);

Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example, further examples and conclusions.

UNIT-IV	MEETING REAL-TIME CONSTRAINTS	Classes: 09

Introduction, creating hardware delays using Timer 0 and Timer 1, example: Generating a precise 50 ms delay, example: Creating a portable hardware delay, Why not use Timer 2? The need for timeout mechanisms, creating loop timeouts and example: Testing loop timeouts, example: A more reliable switch interface, Creating hardware timeouts, example: Testing a hardware timeout, conclusions.

UNIT-V	CASE STUDY: INTRUDER ALARM SYSTEM	Classes: 09

Introduction, The software architecture, key software components used in this example, running the program, the software, conclusions.

Text Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.

Reference Books:

1. Nigel Gardner, "The Microchip PIC in CCS C", Ccs Inc, 2nd Revision Edition, 2002.

Web References:

1. http://www.keil.com/forum/5973/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Embedded%20systems/New_index1.html
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm
4. http://freevideolectures.com/Course/2999/Embedded-Systems-I/5

E-Text Books:

1. http://teachers.teicm.gr/kalomiros/Mtptx/e-books/eBook%20-%20PIC%20Programming%20with%20C.pdf
2. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf
3. http://dsp-book.narod.ru/CPES.pdf
4. http://staff.ustc.edu.cn/~shizhu/WinCE/winCE6%20Fundamentals.pdf
5. http://read.pudn.com/downloads167/ebook/769402/Wrox.Professional.Microsoft.Windows.Embedded.CE.6.0.Nov.2008.eBook-DDU.pdf
6. https://syhpullpdf.files.wordpress.com/2015/05/embedded-systems-textbook-pdf.pdf

ADVANCED JAVA PROGRAMMING AND WEB SERVICES

Open Elective I: AE / (CAD/CAM) / ES / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to :

I. Understand OOPS Concepts Describe client side technologies.
II. Implement database connections.
III. Develop the skills to design user interfaces for web Applications.

UNIT-I	INTRODUCTION TO OOPs	Classes: 09

Basic concepts of OOPs: Java History, Java Features, Comparison in Java and C++ ,Java Virtual Machine, Java Environment, Program, Data types, operators, Control Structure, Classes and Objects, Constructors, Interfaces, Exception Handling.

UNIT-II	APPLETS AND SWINGS	Classes: 09

Applets: Introduction to applet, applet vs application, applet class, advantages of applet, applet lifecycle, applet tag, passing parameters to applet, types of applets, examples; swing: introduction to JFC, swing, Swing, Features, JComponent, JApplet, JFrame, JPannel, JButtons, Jcheckboxes and JRadiobuttons, JTextField, JMenu, JMenuBar

UNIT-III	HTML AND XML	Classes: 09

HTML common tags: list, tables, images, forms, frames; cascading style sheets; introduction to java scripts, objects in java script, dynamic HTML with java script.

XML: document type definition, XML schemas, document object model, presenting XML, using XML processors: DOM and SAX.

UNIT-IV	WEB SERVERS,SERVLETS AND JSP	Classes: 09

Web servers: Tomcat server installation and testing, introduction to servelets: lifecycle of a servelet, JSDK, servelet API, javax. servelet package, reading servelet parameters, reading initialization parameters; servlets: javax, servelet HTTP package, handling http request and responses, using cookies session tracking, security issues, JSP: problem with servelet, anatomy of a JSP Page, JSP processing, JSP application design with MVC architecture, AJAX.

UNIT-V	JDBC AND ODBC	Classes: 09

JDBC & ODBC :Java and JDBC , JDBC vs ODBC, JDBC driver model, JDBC driver types, two-tier architecture for data access ,three-tier architecture for data access , types of driver managers, connecting to an ODBC data source, JDBC programs

Text Books:

1. Dreamtech Chris Bates, "Web Programming, building internet applications", WILEY , 2nd Edition.
2. Patrick Naughton and Herbert Schildt, "The complete Reference Java 2" , TMH, 5th Edition.
3. Hans Bergsten , "Java Server Pages", SPD O"Reilly.

Reference Books:

1. Sebesta, "Programming world wide web", Pearson Core,8th Edition 2008.
2. Marty Hall, Larry Brown, "Servlets and Javaserver Pages", Volume 1: Core Technologies, Pearson 2nd Edition 1998.

Web References:

1. http://engineeringppt.blogspot.in/2010/01/advance-java-web-technology.html
2. http://www.scoopworld.in/2015/02/ajwt-ppt-lab-materials-cse.html
3. http://jntuh.ac.in/new/bulletin_board/WEB_TECHNOLOGIES.pdf

E-Text Books:

1. http://www.freetechbooks.com/advanced-programming-for-the-java-2-platform-t36.html
2. https://www.mkyong.com/featured/top-5-free-java-ebooks/
3. http://www.e-booksdirectory.com/listing.php?category=226

INTRODUCTION TO AEROSPACE ENGINEERING

Open Elective I: (CAD/CAM) / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAE701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Outline different aspects of flight vehicles and their operational environment.
II. Description of flow behavior of one-dimensional incompressible and compressible flow, two-dimensional flow and finite wing.
III. Apprise about boundary layer effects, aerodynamic forces on airfoils, wings and high-lift systems.
IV. Analyze airplane performance, stability and control.

UNIT-I	INTRODUCTION TO AERONAUTICS AND ASTRONAUTICS	Classes: 08

Historical perspective of aeronautics and astronautics, anatomy of the airplane, anatomy of a space vehicle, aerodynamic forces; Parameters affecting aerodynamic forces: Dimensional analysis; Theory and experiment, wind tunnels; Atmosphere: Properties of U.S. standard atmosphere, definitions of altitude.

UNIT-II	ONE DIMENSIONAL FLOW IN INCOMPRESSIBLE AND COMPRESSIBLE FLUIDS, TWO DIMENSIONAL FLOW AND FINITE WING	Classes: 10

Continuity equation, Bernoulli's equation; Application of Bernoulli's equation: Airspeed indicators and wind tunnels, one dimensional compressible flow concepts, speed of sound, compressible flow equations in a variable-area stream tube, application to airspeed measurement, applications to channels and wind tunnels; Two dimensional flow and finite wing: Limitations of one dimensional flow equations; Theory of lift: circulation, Airfoil pressure distribution, Helmholtz vortex theorems, Simulating the wing with a vortex Line, downwash, elliptic lift distribution; Lift and drag: Momentum and energy, Slope of finite wing lift curve, verification of Prandtl wing theory, additional effects of wing vortices, search for reduced induced drag.

UNIT-III	VISCOUS EFFECTS, DRAG DETERMINATION, AIRFOILS, WINGS AND HIGH-LIFT SYSTEMS	Classes: 10

Boundary layer, boundary layer on bluff bodies, creation of circulation, laminar and turbulent boundary layers: skin friction, nature of Reynolds number, effect of turbulent boundary layer on separation; Total Incompressible drag: Parasite drag, drag due to lift, importance of aspect ratio; Compressibility drag: Prediction of drag divergence Mach number, sweptback wings, total drag.

Supersonic flow: Shock waves and Mach waves, supersonic wing lift and drag, area rule, supersonic aircraft, airfoils; Wings: early airfoil development, modern airfoils, supersonic airfoils, airfoil pitching moments, effects of sweepback on lift, airfoil characteristics, airfoil selection and wing design; High-lift Devices: Airfoil maximum lift coefficient, leading and trailing edge devices, effect of sweepback, deep stall, effect of Reynolds number, propulsive lift.

UNIT-IV	AIRPLANE PERFORMANCE, STABILITY AND CONTROL, AEROSPACE PROPULSION	Classes: 09

Level flight performance, climb performance, range, endurance, energy-state approach to airplane performance, takeoff performance, landing performance; Static longitudinal stability; Dynamic longitudinal stability; Dynamic lateral stability; Control and maneuverability: Turning performance, control systems, active controls; Aerospace propulsion: Piston engines, gas turbines; Speed limitations of gas turbines: Ramjets, propellers, overall propulsion efficiency, rocket engines, rocket motor performance, propulsion-airframe integration.

UNIT-V	AIRCRAFT STRUCTURES, HYPERSONIC FLOWS, ROCKET TRAJECTORIES AND ORBITS	Classes: 08

Aircraft structures: Importance of structural weight and integrity, development of aircraft structures, importance of fatigue, materials, loads, weight estimation; Hypersonic flows: temperature effects, Newtonian theory; rocket trajectories, multistage rockets, escape velocity, circular orbital or satellite velocity, elliptical orbits, orbital maneuvers.

Text Books :

1. Richard S. Shevell, Fundamentals of Flight, Pearson Education Publication, 2nd Edition, 1988.
2. Anderson J. D, "Introduction to Flight", McGraw-Hill, 5th Edition, 1989.
3. Newman D, "Interactive Aerospace Engineering and Design", McGraw-Hill, 1st Edition, 2002.
4. Barnard R.H and Philpot. D.R, "Aircraft Flight", Pearson, 3rd Edition, 2004.

Reference Books:

1. Introduction to Flight, John D. Anderson, Jr., Tata McGraw-Hill Publishing Company, Fifth Edition, 5th Edition, 2007.
2. Kermode, A. C, "Flight without Formulae", McGraw Hill, 4th Edition, 1997.
3. Swatton P. J, "Flight Planning", Blackwell Publisher, 6th Edition, 2002.

Web References:

1. https://fas.org/irp/doddir/army/fm3-04-203.pdf
2. http://www.aerospaceengineering.es/book/
3. http://www.ne.nasa.gov/education/
4. http://nptel.ac.in

E-Text Books:

1. http://www.e-booksdirectory.com/
2. http://www.adl.gatech.edu/extrovert/Ebooks/ebook_Intro.pdf
3. http://www.academia.edu/7950378/Introduction_to_Flight_-_Anderson_5th_Ed._

GEOSPATIAL TECHNIQUES

Open Elective-II: AE / (CAD/CAM) / CSE / ES / SE /PEED

Course Code	Category	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Provide technical skills to use geo-referenced data for the purpose of economic, educational, and social development.
II. Learn the art of image interpretation and mapping.
III. Learn the applications of geospatial technologies.

UNIT-I	INTRODUCTION TO GEOSPATIAL DATA	Classes: 09

Geospatial data, why to study geospatial data, importance of geospatial technology, spatial data infrastructure, three important geospatial technologies, spatial elements., coordinates and coordinate systems, basic electromagnetic radiation.

UNIT-II	PHOTOGRAMMETRY AND REMOTE SENSING	Classes: 10

Definition and scope, history of photogrammetry and remote sensing, principle, remote sensing data acquisition, Remote sensing data analysis methods, advantages and limitations, hardware and software required. Map Vs mosaic, ground control points. Energy interactions with atmosphere and earth surface features.

UNIT-III	MAPPING AND CARTOGRAPHY	Classes: 10

What is map and its importance, map scale and types, elements of map and Indexing, map coordinate systems, visual interpretation of satellite images, and interpretation of terrain evaluation.

Introduction to digital data analysis, cartographic symbolization, classification of symbols, colours in cartography, scale and purpose of a map, cartographic design, thematic cartography, digital cartography.

UNIT-IV	GEOGRAPHIC INFORMATION SYSTEM	Classes:10

Introduction to GIS, definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, theoretical framework for GIS, GIS data structures, data collection and input overview, processing of spatial data, data Input or output, vector data model, raster data model, geometric representation of spatial feature and data structure. Spatial data and modeling, TIN, DTM, overlay, spatial measurement etc.,

UNIT-V	GEOSPATIAL TECHNOLOGIES APPLICATIONS	Classes:09

Visual image analysis for land use / land cover mapping, land use and land cover in water resources, surface water mapping and Inventory, geological and soil mapping, agriculture applications for forestry applications, water resources applications, urban and regional planning, environmental assessment, principles of land form identification and evaluation: sedimentary, igneous and metamorphic rock terrain.

Text Books :

1. John D. Bossler, "Manual of Geospatial Science and Technology" Taylor & Francis.
2. M. Anji Reddy, "Textbook of Remote Sensing and Geographical Information Systems", BS Publications.

Reference Books:

1. C. P. Lo Albert, K.W. Yonng, "Concepts and Techniques of GIS", Prentice Hall (India) Publications.
2. Peter A Burragh and Rachael A. Mc Donnell, "Principles of Geo- Physical Information Systems", Oxford Publishers, 2004.
3. M. Anji Reddy, "Geo-informatics for Environmental Management" BS Publications.

Web References:

1. https://www.aaas.org/content/what-are-geospatial-technologies
2. http://www.istl.org/10-spring/internet2.htmls

E-Text Books:

1. http://www.springer.com/us/book/9781441900494
2. https://www.amazon.com/Introduction-Geospatial-Technologies-Bradley-Shellito/dp/146413345X
3. http://www.springer.com/us/book/9784431555186
4. http://gep.frec.vt.edu/VCCS/materials/2011/Day1/Handouts/1.2-Ch.1_GIS_Intro.pdf
5. http://www.slideshare.net/CuteGirl11/introduction-to-geospatial-technologies-pdf

SOLAR PHOTOVOLTAIC ENERGY CONVERSION

Open Elective II : AE / (CAD / CAM) / CSE / ES / SE / ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPE702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

This course should enable the students to:

I. Illustrate the operation of Photo voltaic power generation.
II. Analyze the characteristics of solar photovoltaic power generation.
III. Design energy conversion systems with low impact on environment.
IV. Understand the technology of fuel cells.

UNIT-I	INTRODUCTION	Classes: 09

Introduction: Highlights, an atomic description of silicon, the effect of light on silicon the potential barrier, the function of the barrier, the potential barrier in action the electric current.

UNIT-II	PHYSICAL ASPECTS OF SOLAR CELL EFFICIENCY	Classes: 09

Physical aspects of solar cell efficiency: Reflection light with too little or too much energy, recombination of electron hole pairs, direct recombination indirect recombination, resistance, self shading, performance degradation at non optimal temperatures, high temperature losses, low temperature losses.

UNIT-III	SINGLE CRYSTAL SILICON SOLAR CELLS AND ARRAYS	Classes: 09

Single Crystal Silicon Solar cells: New fabrication edge, defined film fed growth (dendritic web growth, Ribbon to ribbon (rtr) growth innovative cell designs back surface fields (BSF) and other minority carrier mirrors (MCM). Schottky barrier cells, inversion layer cells, cells for concentrated sun light advances in component technology highlights, PV building blocks, boosting voltage and amperage design requirements for connecting components, the physical connection. placing the cells;

Arrays: Array support, module covers, module cooling, hybrid designs, Brayton cycle, electricity production, the rmo electric generators, intercepting sunlight, arrays with relectors, arrays that follow the sun, controlling intensity, imaging optics, mirrors,
lenses tracking devices, steering mechanisms, tracking device controls, optimizing the use of the spectrum, splitting the spectrum, converting the spectrum to a single color.

UNIT-IV	SOLAR ARRAY CONSTRUCTIONS	Classes: 09

Solar array constructions: Intercepting sunlight, arrays with relectors, arrays that follow the sun, controlling intensity, imaging optics, mirrors, lenses; Tracking devices: steering mechanisms, tracking device controls, optimizing the use of the spectrum, splitting the spectrum, converting the spectrum to a single color.

UNIT-V	PV SUPPORT EQUIPMENT	Classes: 09

PV support equipment: PV vs conventional electricity, storing PV's electricity, batteries, fuel cells, power conditioning equipment the inverter regulators other devices; system analysis, design procedure, design constraints, other considerations.

Text Books:

1. CS Solanki, "Solar photovoltaic's fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2011.
2. Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.
3. Rai,G.D., "Non- conventional resources of energy", Khanna publishers, Fourth edition, 2010.

Reference Books:

1. Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.
2. Pai, B. R. and Ram Prasad, "Power Generation through Renewable Sources of Energy", Tata McGraw Hill, New Delhi, 1991.
3. Bansal, Kleeman and Meliss, "Renewable Energy Sources and Conversion Techniques", Tata Mc Graw Hill, 1990.
4. Godfrey Boyl, "Renewable Energy: Power sustainable future", Oxford University Press, Third edition, 2012.
5. B.H.Khan, "Non-Conventional Energy Resources", The McGraw Hills, Second edition, 2009.
6. John W Twidell and Anthony D Weir, "Renewable Energy Resources", Taylor and Francis, 2006.

Web References:

1. http://www.tue.nl/fileadmin/content/faculteiten/tn/PMP/White_papers/Delft2012_-_ALD4PV.pdf
2. http:// www.en.wikipedia.org/wiki/Photovoltaics
3. http://www.desware.net/Sample-Chapters/D06/D10-014.pdf
4. http://www.southampton.ac.uk/~solar/files/Strasbourg.pdf
5. http:// www.science.nasa.gov/science-news/science-at-nasa/2002/solarcells/

E-Text Books:

1. http://www.nrel.gov/docs/legosti/old/1448.pdf
2. http://www.irena.org/DocumentDownloads/Publications/IRENAETSAP%20Tech%20Brief%20E11%20Solar%20PV.pd
3. http://www.opalrt.com/sites/default/files/technical_papers/SOLAR%20PHOTOVOLTAIC%20ENERGY%20GENERATION%20AND%20CONVERSION.pdf

COMPUTER GRAPHICS

Open Elective II: AE / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCC702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the basics of Computer Graphics needed for CAD/ CAM applications.
II. Apply the geometrical modeling for computer graphics.
III. Apply data structures in computer graphics.

UNIT-I	INTRODUCTION TO COMPUTER GRAPHICS	Classes: 09

Introduction: Role of computer graphics in CAD/CAM, configuration of graphic workstations, menu design and graphical user interfaces, customization and parametric programming.

UNIT-II	GEOMETRIC TRANSFORMATIONS, PROJECTIONS AND FUNDAMENTALS OF 2D AND 3D TRANSFORMATIONS	Classes: 09

Geometric transformations and projections: Vector representation of geometric entities, homogeneous coordinate systems; Fundamentals of 2D and 3D transformations: reflection, translation, rotation, scaling, and shearing, various types of projections.

UNIT-III	DEVELOPMENT OF GEOMENTRICAL MODELLING	Classes: 09

Curves: Modeling planar and space curves, analytical and synthetic approaches, non-parametric and parametric equations.

Surfaces: Modeling of bi-parametric freedom surfaces, Coons, Bezier, B-spline, and NURBS surfaces, surface manipulation techniques.

UNIT-IV	GEOMENTRICAL MODELING	Classes: 09

Geometric Modeling: Geometric modeling techniques, wireframe modeling, solid modeling: B Rep CSG, hybrid modelers, feature based, parametric and variation modeling.

UNIT-V	DATA STRUCTURES IN COMPUTER GRAPHICS	Classes: 09

Data Structure in Computer Graphics: Introduction to product data standards and data structures, data-base integration for CIM.

Text Books:

1. D. F. Rogers, J. A. Adams, “Mathematical Elements for Computer Graphics”, Tata McGraw Hill. 1989.
2. I. D. Faux, M. J. Pratt, “Computational Geometry for Design and Manufacture”, Ellis Horwood, 1979.
3. Mortenson, M. E., “Geometric Modeling”, 3rd Ed., Industrial Press. 2006
4. Ibrahim Zeid, “CAD/CAM: Theory and Practice”, Tata McGraw Hill, 1998.
5. B. K. Choi, B. K., “Surface Modeling for CAD/CAM", John Wiley & Sons 1991

Reference Books:
1.C. Pozrikidis, “Introduction to Theoretical and Computational Fluid Dynamics”, Oxford University Press, 2nd Edition, 2013. 2.V. Patankar, Hema shava Suhas , “ Numerical heat transfer and fluid flow”, Tata McGraw Hill
Web References:
1. http://nptel.ac.in/courses/106106090/ 2. http://nptel.ac.in/courses/112102101/
E-Text Books:
1. http://www.freebookcentre.net/CompuScience/Free-Computer-Graphics-Books-Download.html 2.https://docs.google.com/file/d/0B_YZ665nBRhlYmNiOTU5ZDItMmU2OC00YTVmLThiNmMtMjg 3 Y2E3ZTgwZDYw/edit?hl=en_US&pref=2&pli=1

MICROCONTROLLERS FOR EMBEDDED SYSTEM DESIGN

Open Elective II: AE / (CAD / CAM) / CSE / SE / ST /PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES702	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I. Understand hardware units and devices for design of embedded systems.
II. Use architectures of embedded RISC processors and system on chip processor design of embedded systems.
III. Analyze interrupt latency, context switching time, for development of device drives for timing devices.

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 09

Overview of embedded systems, processor embedded into a system, embedded hardware units and devices in system, embedded software, complex system design, design process in embedded system, formalization of system design, classification of embedded systems.

UNIT-II	MICROCONTROLLERS	Classes: 09

8051 architecture, input/output ports and circuits, external memory, counters and timers, PIC controllers; Interfacing processor 8051, PIC, memory interfacing, I/O devices, memory controller and memory arbitration schemes.

UNIT-III	EMBEDDED RISC PROCESSORS	Classes: 09

programmable system on chip architectures, continuous timer blocks, switched capacitor blocks, I/O blocks, digital blocks, programming of PSOC;

Embedded RISC processor architecture, ARM processor architecture, registers set, modes of operation and overview of Instructions.

UNIT-IV	INTERRUPTS AND DEVICE DRIVERS	Classes: 09

Exceptions and Interrupt handling Schemes, Context and periods for context switching, deadline and interrupt latency; Device driver using interrupt service routine, serial port device driver and device drivers for internal programmable timing devices.

UNIT-V	NETWORK PROTOCOLS	Classes: 09

Serial communication protocols, Ethernet protocol, SDMA, Channel and IDMA, external bus interface.

Text Books:

1. Raj Kamal, "Embedded Systems, Architecture Programming and Design", Tata Mc Graw Hill, 2nd Edition, 2008.
2. Muhammad Ali Mazidi, Rolin D. Mckinaly, Danny Causy, "PIC Microcontroller and Embedded Systems", Pearson Education, 1st Edition, 2008.

3. Robert Ashpy, “Designers Guide to the Cypress PSOC”, Elsevier, 1st Edition, 2005.

Reference Books:

1. Jonathan W. Valvano – Brookes / Cole, “Embedded Microcomputer Systems, Real Time Interfacing”, Thomas Learning, 1st Edition, 1998.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM Systems Developers Guides, Design & Optimizing System Software”, Elsevier, 1st Edition, 2004.
3. John B. Peatman, “Designing with PIC Microcontrollers”, PH Inc, 1st Edition, 1998.

Web References:

1. http://nptel.ac.in/syllabus/108102045/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT,KANPUR/microcontrollers/micro/ui/Course_home1_1.Htm

E-Text Books:

1. http://microcontrollershop.com/default.php?cPath=239
2. http://www.sciencedirect.com/science/book/9780750667555
3. https://books.google.co.in/books/about/Embedded_Systems_Design_with_8051_Microc.html?id=YiTa,HChn0UC&redir_esc=y
4. https://books.google.co.in/books/about/Microcontroller_And_Embedded_Systems.html?id=4GrXJeC6HFkC

LINUX PROGRAMMING

Open Elective II: AE / (CAD/CAM) / ES / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to :

I. Understand basic Linux utilities and Shell scripting language (bash) to solve Problems.
II. Explore on implementation of Linux utilities using system calls.
III. Develop the skills necessary for systems programming
IV. Illustrate the basic skills required to write inter process communication programs.

UNIT-I	LINUX UTILITIES	Classes: 09

File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities; Sed-Scripts, Operation, Addresses, Commands, awk-Execution, Fields and Records, Scripts, Operation, Patterns, Actions, Associative Arrays, String and Mathematical functions, System commands in awk, Applications.

UNIT-II	SHELL PROGRAMMING	Classes: 09

Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, debugging shell scripts.

UNIT-III	FILES AND DIRECTORIES	Classes: 09

Files: File types, File System Structure, file metadata: Inodes, kernel support for files, system calls for file I/O operations: open, create, read, write, close, lseek, dup2, file status information: stat family, file and record locking: fcntl function.

File permissions - chmod, fchmod, file ownership, links: soft and hard links: symlink, link, unlink. Directories: Creating, removing and changing Directories, obtaining current working directory: getcwd, Directory contents, Scanning Directories: opendir, readdir, closedir, rewinddir functions.

UNIT-IV	INTERPROCESS COMMUNICATION AND MESSAGE QUEUES	Classes: 09

Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pies-creation, IPC between related processes using unnamed pipes, FIFOs: creation, IPC between unrelated processes using FIFOs(Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Message Queues: Kernel support for messages, APIs for message queues, client/server example. Semaphores-Kernel support for semaphores, APIs for semaphores, file locking with semaphores.

UNIT-V	SHARED MEMORY AND SOCKETS	Classes: 09

Shared Memory: Kernel support for shared memory, APIs for shared memory, shared memory example, Sockets: Introduction to Berkeley Sockets, IPC over a network, Client-Server model, Socket address structures (unix domain and Internet domain), Socket system calls for connection oriented protocol and connectionless protocol.

Text Books:

1. T. Chan , "Unix System Programming using C++", PHI, 2nd Edition,2005.
2. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH, 2011.
3. W. R. Stevens , "Unix Network Programming", PHI, 2nd Edition ,1999.

Reference Books:

1. Mathew, R. Stones, Wrox, "Beginning Linux Programming", Wiley India Edition,4th Edition,2008.
2. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition,Pearson, 2006.
3. Hoover, "SystemProgramming with C and Unix", Pearson, 2nd Edition ,2009.
4. K. A. Robbins, "Unix System Programming, Communication, Concurrency and Threads", Pearson Education, 6th Edition, 2007.

Web References:

1. http://www.fuky.org/abicko/beginning-linux-programming.pdf
2. https://www.pdc.kth.se/about/links/linux-programming-for-beginners
3. http://www.tutorialspoint.com/unix/unix_tutorial.pdf
4. http://www.rpi.edu/dept/arc/training/shell/slides.pdf

E-Text Books:

1. http://onlinevideolecture.com/ebooks/?subject=Linux
2. http://www.onlineprogrammingbooks.com/linux-succinctly/
3. http://ebook-dl.com/item/beginning_linux_programming_4th_edition_neil_matthew_richard_stones/

RESEARCH METHODOLOGY

Open Elective II: AE / (CAD / CAM) / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS703	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Identify an appropriate research problem in their interesting domain.
II. Organize and conduct research project.
III. Prepare a research project thesis report.
IV. Understand the law of patent and copyrights.
V. Adequate knowledge on process for filing Patent.

UNIT-I	INTRODUCTION	Classes: 09

Definition, types of research, research approaches, research process, validity and reliability in research, features of good design, types of research design, and basic principles of experimental design.

UNIT-II	MEASUREMENT AND SCALING TECHNIQUES	Classes: 09

Errors in measurement, tests of sound measurement, scaling and scale construction techniques, forecasting techniques, time series analysis, interpolation and extrapolation.

UNIT-III	METHODS OF DATA COLLECTION	Classes: 09

Primary data, questionnaire and interviews, collection of secondary data, cases and schedules.

Professional attitude and goals, concept of excellence, ethics in science and engineering, some famous frauds in science, case studies.

UNIT-IV	INTERPRETATION OF DATA AND REPORT WRITING	Classes: 09

Layout of a research paper, techniques of interpretation, making scientific presentation at conferences and popular lectures to semi technical audience, participating in public debates on scientific issues.

UNIT-V	INTRODUCTION TO INTELLECTUAL PROPERTY	Classes: 09

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights; Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law; Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Text Books:

1. C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publishers, 2nd Edition, 2004.
2. P. Gupta, "Statistical Methods", Sultan Chand and Sons, New Delhi, 1st Edition, 2005.
3. Richard W. Stim, "Intellectual Property: Patents, Trademarks, and Copyrights", Cengage learning, 2nd Edition, 2001.

Reference Books:

1. P. Narayana Reddy, G. V. R. K. Acharyulu, "Research Methodology and Statistical Tools", Excel Books, New Delhi, 1st Edition, 2008.
2. Prabuddha Ganguli, "Intellectual Property Right, Unleashing the Knowledge Economy", Tata Mc Graw Hill Publishing Company Ltd, 1st Edition, 2001.

Web References:

1. http://nptel.ac.in/courses/109103024/40
2. http://study.com/academy/topic/introduction-to-research-methods.html
3. https://www.vutube.edu.pk/vu-lectures/viewcategory/240/research-methods-sta630

E-Text Books:

1. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf
2. http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th_07.pdf
3. http://euacademic.org/BookUpload/9.pdf

NDUSTRIAL AERODYNAMICS AND WIND ENERGY

Open Elective II : (CAD/CAM) / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAE702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the atmospheric boundary layer and conditions.
II. Describe the wind energy and its application in turbines.
III. Familiarize with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations.

UNIT-I	ATMOSPHERIC WINDS AND ATMOSPHERIC BOUNDARY LAYER	Classes: 08

Causes of wind thermal drive, Coriolis effect, pressure gradient effect, Geotropic winds; Land and sea breeze, mountain winds, thermals, cause of turbulence at ground level; Atmospheric boundary layer, velocity profile laws, effects of terrain on atmospheric boundary Layer; Wind tunnels basic features and components; Wind tunnel models, role of non-dimensional groups; Creation of atmospheric boundary layer type flow in a wind tunnel.

UNIT-II	WIND ENERGY	Classes: 10

Ship propulsion, sails, lift and drag translators, modern yachts; Horizontal and vertical axis wind turbines: History, first example of automatic feedback control for yaw in 16^{th} century English windmills, classification. Horizontal axis wind turbine: Elementary actuator disc theory, Betz coefficient; Definition of power coefficient and torque coefficient for all wind turbines; Working principle, power coefficients, tip speed ratio explanation, by introductory blade element theory, conventional horizontal axis wind turbine, savonious vertical axis wind turbine, Darries vertical axis wind turbine, merits and demerits of horizontal axis wind turbines and vertical axis wind turbines.

UNIT-III	VEHICLE AERODYNAMICS	Classes: 10

Relative importance of rolling resistance and aerodynamics resistance, power requirements and drag coefficients of automobiles, notch front and notch rear wind screens versus streamlined shape, causes of vortex formation and drag, attached transverse vortex , trailing vortex, trailing vortex drag, effect of floor height on lift, effects of cut bank angle; Rear end taper.

Side panels and bottom, effects of chamfering of edges and cambering of roof and side panels; Racing cars: Traction and steering strip and use of aerofoils, high cornering seed; Commercial transport vehicles: Drag reduction on buses and tucks, driver cabin and trailer combinations.

UNIT-IV	BUILDING AERODYNAMICS	Classes: 09

Use of light weight components in modern buildings, pressure distribution on low-rise buildings, wind forces on buildings-aerodynamics of flat plate and circular cylinder , critical Reynold's no, sub -, super- & ultra critical Reynold's No. Role of wind tunnel requirements in determining shape factors (Drag coefficients) of building/structure shapes such as circular cylinder (chimneys & towers), rectangle, I-shape, L-shape, H-shape etc. vortex shedding & transverse oscillating loads. Slenderness ratio & correction factor. Special problems of tall buildings, interference effect of building.

UNIT-V	FLOW INDUCED VIBATIONS	Classes: 08

Classification: Vortex induced vibration and flow induced instability such as galloping and stall flutter; Effects of Reynolds number on wake formation of bluff shapes; Vortex induced vibration: Experimental determination of strouhal numbers for different shapes such as circular cylinder, square, rectangle, L-shape ect, universal strouhal number, unsteady Bernoulli equation, concept of added mass, resonance; Fluid-structure interaction: Effect of transverse cylinder motion on flow and wake, lock-in vortex shedding near resonant frequency, experimental evidence of cylindrical motion influencing flow and thereby reducing strength of shed vortices; Methods of suppression of vortex induced vibration; Galloping & Stall flutter: Motion of one degree-of-freedom, quasi steady flow assumption, aerodynamic damping; Galloping: Force in the direction of plunging (transverse motion) and positive force coefficient, critical speed, galloping of transmission wire with winter ice, stall flutter of airfoils.

Text Books :

1. Siraj Ahmed, "Wind Energy theory and practice", PHI learning Pvt Ltd., 3rd Edition, 2015.
2. R. D. Blevins, "Flow Induced Vibrations", Van Nostard, 2nd Edition, 1990.
3. P. Sachs, "Wind Forces in Engineering", Pergamon press, 2nd Edition, 1988.
4. N. G. Calvert, "Wind Power Principles", Charles Griffin & co. London, 1st Edition, 1979.

Reference Books:

1. R. S. Scorer, "Environmental Aerodynamics", Ellis Harword Ltd, England, 1st Edition, 1978.
2. M. Sorvan, "Aerodynamics Drag Mechanisms of Bluff Bodies and Road vehicles", plenum press, 2nd Edition, 1978.

Web References:

1. http://www.mech.canterbury.ac.nz/research/fluid%20mechanics.shtml
2. http://www.journals.elsevier.com/journal-of-wind-engineering-and-industrial-aerodynamics

E-Text Books:

1. http://www.sciencedirect.com/science/journal/01676105
2. https://www.scribd.com/doc/42602999/Flow-Induced-Vibration-by-Robert-D-Blevins-2nd-Ed
3. http://store.elsevier.com/Wind-Forces-in-Engineering/Peter-Sachs/isbn-9781483148359/

INDUSTRIAL AERODYNAMICS AND WIND ENERGY

OPEN ELECTIVE II : (CAD/CAM) / CSE / ES / SE / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAE702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the atmospheric boundary layer and conditions.
II. Describe the wind energy and its application in turbines.
III. Familiarize with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations.

UNIT-I	ATMOSPHERIC WINDS AND ATMOSPHERIC BOUNDARY LAYER	Classes: 08

Causes of wind thermal drive, Coriolis effect, pressure gradient effect, Geotropic winds; Land and sea breeze, mountain winds, thermals, cause of turbulence at ground level; Atmospheric boundary layer, velocity profile laws, effects of terrain on atmospheric boundary Layer; Wind tunnels basic features and components; Wind tunnel models, role of non-dimensional groups; Creation of atmospheric boundary layer type flow in a wind tunnel.

UNIT-II	WIND ENERGY	Classes: 10

Ship propulsion, sails, lift and drag translators, modern yachts; Horizontal and vertical axis wind turbines: History, first example of automatic feedback control for yaw in 16^{th} century English windmills, classification. Horizontal axis wind turbine: Elementary actuator disc theory, Betz coefficient; Definition of power coefficient and torque coefficient for all wind turbines; Working principle, power coefficients, tip speed ratio explanation, by introductory blade element theory, conventional horizontal axis wind turbine, savonious vertical axis wind turbine, Darries vertical axis wind turbine, merits and demerits of horizontal axis wind turbines and vertical axis wind turbines.

UNIT-III	VEHICLE AERODYNAMICS	Classes: 10

Relative importance of rolling resistance and aerodynamics resistance, power requirements and drag coefficients of automobiles, notch front and notch rear wind screens versus streamlined shape, causes of vortex formation and drag, attached transverse vortex , trailing vortex, trailing vortex drag, effect of floor height on lift, effects of cut bank angle; Rear end taper: Side panels and bottom.

Effects of chamfering of edges and cambering of roof and side panels; Racing cars: Traction and steering strip and use of aerofoils, high cornering seed; Commercial transport vehicles: Drag reduction on buses and tucks, driver cabin and trailer combinations.

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UNIT-V	FLOW INDUCED VIBATIONS	Classes: 08

Classification: Vortex induced vibration and flow induced instability such as galloping and stall flutter; Effects of Reynolds number on wake formation of bluff shapes; Vortex induced vibration: Experimental determination of strouhal numbers for different shapes such as circular cylinder, square, rectangle, L-shape ect, universal strouhal number, unsteady Bernoulli equation, concept of added mass, resonance; Fluid-structure interaction: Effect of transverse cylinder motion on flow and wake, lock-in vortex shedding near resonant frequency, experimental evidence of cylindrical motion influencing flow and thereby reducing strength of shed vortices; Methods of suppression of vortex induced vibration; Galloping & Stall flutter: Motion of one degree-of-freedom, quasi steady flow assumption, aerodynamic damping; Galloping: Force in the direction of plunging (transverse motion) and positive force coefficient, critical speed, galloping of transmission wire with winter ice, stall flutter of airfoils.

Text Books :

1. Siraj Ahmed, "Wind Energy theory and practice", PHI learning Pvt Ltd., 3rd Edition, 2015.
2. R. D. Blevins, "Flow Induced Vibrations", Van Nostard, 2nd Edition, 1990.
3. P. Sachs, "Wind Forces in Engineering", Pergamon press, 2nd Edition, 1988.
4. N. G. Calvert, "Wind Power Principles", Charles Griffin & co. London, 1st Edition, 1979.

Reference Books:

1. R. S. Scorer, "Environmental Aerodynamics", Ellis Harword Ltd, England, 1st Edition, 1978.
2. M. Sorvan, "Aerodynamics Drag Mechanisms of Bluff Bodies and Road vehicles", plenum press, 2nd Edition, 1978.

Web References:

1. http://www.mech.canterbury.ac.nz/research/fluid%20mechanics.shtml
2. http://www.journals.elsevier.com/journal-of-wind-engineering-and-industrial-aerodynamics

E-Text Books:

1. http://www.sciencedirect.com/science/journal/01676105
2. https://www.scribd.com/doc/42602999/Flow-Induced-Vibration-by-Robert-D-Blevins-2nd-Ed
3. http://store.elsevier.com/Wind-Forces-in-Engineering/Peter-Sachs/isbn-9781483148359/

VISION AND MISSION OF THE INSTITUTE

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.

M.TECH - PROGRAM OUTCOMES (PO's)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(Conduct Investigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change **(Life-long learning).**

OBJECTIVES OF THE DEPARTMENT

DEPARTMENT OF CIVIL ENGINEERING

Program Educational Objectives (PEO's)

The current Civil Engineering program educational objectives were developed as part of the program's ongoing efforts to maintain through innovation in undergraduate program that meets the needs of our constituents. The current educational objectives of the Civil Engineering program are:

PEO – I: Capable to analyze, design, build, maintain, or improve civil engineering-based systems in the context of environmental, economic, and societal requirements.

PEO – II: Graduates will be provided with an educational foundation that prepares them to design and conduct experiments, to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability as well as to analyze and interpret data.

PEO – III: Graduates will demonstrate their ability to function on multidisciplinary teams.

PEO – IV: Graduates will develop an ability to identify, formulate, and solve engineering problems and to engage in life-long learning in advanced areas of Civil Engineering and related fields.

PEO – V: Graduates will have an ability to use the techniques, skills, and modern engineering tools necessary for Civil engineering practice and serve the community as ethical and responsible professionals.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: **Understanding:** Graduates will have an ability to describe, analyze, and solve problems using mathematics and systematic problem-solving techniques.

PSO – II: **Analytical Skills:** Graduates will have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

PSO – III: **Broadness:** Graduates will have a broad education necessary to understand the impact of engineering solutions in a global, economic, and societal context.

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 makeup Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21. **How fast Syllabi can be and should be changed?**
Autonomy allows us the freedom to change the syllabi as often as we need.

22. **Will the Degree be awarded on the basis of only final year performance?**
No. The CGPA will reflect the average performance of all the semester taken together.

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

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

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

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

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

28. **Who declares the result?**
The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29. **Who will keep the Student Academic Records, University or IARE?**
It is the responsibility of the Dean, 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 2016-2017 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 HOD concerned/ Principal.
11. I hereby acknowledge that I have received a copy of IARE - R16 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number