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

## BACHELOR OF TECHNOLOGY
## AERONAUTICAL ENGINEERING

## ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI
## (Based on AICTE Model Curriculum)

## IARE - R18

**B.Tech Regular Four Year Degree Program**

**(for the batches admitted from the academic year 2018- 2019)**

**&**

**B.Tech (Lateral Entry Scheme)**

**(for the batches admitted from the academic year 2019 - 2020)**

**FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE**

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"Take up one idea.
Make that one idea your life-think of it, dream of it, 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

**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.

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

**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 Year:** It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and one supplementary semester.

**Branch:** Means specialization in a program like B.Tech degree program in Aeronautical Engineering, B.Tech degree program in Computer Science and Engineering etc.

**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.

**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 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.

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

**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.

**Certificate Course:** It is a course that makes a student to have hands-on expertise and skills required for holistic development in a specific area/field.

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

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

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

**Course:** A course is a subject offered by a department 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/tutorial 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 up to 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.

**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 Semester:** Student who doesn't want to register for any semester can apply in writing in prescribed format before the 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.

**Honours:** An Honours degree typically refers to a higher level of academic achievement at an undergraduate level.

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

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

**Minor:** Minor are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech degree.

**Pre-requisite:** A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

**Professional Elective:** It indicates 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, UG degree program: Bachelor of Technology (B.Tech); PG degree program: Master of Technology (M.Tech) / Master of Business Administration (MBA).

**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 final 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 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 B.Tech programs offered by Institute, are designated as "IARE Regulations - R18" 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. Odd semester commences usually in July and even semester in December of every year.

**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 Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, is an affiliating University.

**Withdraw from a Course:** Withdrawing from a course means that a student can drop from a course within the first two weeks of 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.

# 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 including J N T University Hyderabad (JNTUH), Hyderabad and AICTE, New Delhi. 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. 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 such as Academic Council and Board of Studies (BOS) 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 in 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 from the principal of the institute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is requested for the successful implementation of the autonomous system in the larger interests of the institute and brighter prospects of engineering graduates.

**PRINCIPAL**

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

# ACADEMIC REGULATIONS

**B.Tech. Regular Four Year Degree Program**
**(for the batches admitted from the academic year 2018 - 19)**
**&**
**B.Tech. (Lateral Entry Scheme)**
**(for the batches admitted from the academic year 2019 - 20)**

For pursuing four year undergraduate Bachelor of Technology degree program of study in Engineering (B.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

## Preamble:

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology program with 160 credits in the entire program of 4 years, and additional 20 credits can be acquired for the degree of B.Tech with **Honours or additional Minor in Engineering**. These additional 20 credits will have to be acquired with online courses (MOOCs), perhaps for the first time in the country, to tap the zeal and excitement of learning beyond the classrooms. So, the students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive open online courses where the rare expertise of world famous experts from academics and industry are available.

Separate certificate will be issued in addition to regular degree program mentioning that the student has cleared Honours / Minor specialization in respective courses in addition to scheduled courses for B.Tech programs.

## 1. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEIs) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system in the 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 lectures / tutorials / laboratory work / field work / project work / comprehensive Examination / seminars / assignments / MOOCs / alternative assessment tools / 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.
2. Undergo additional courses of interest.
3. Adopt an interdisciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

## 2. MEDIUM OF INSTRUCTION

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

## 3. PROGRAMS OFFERED

Presently, the institute is offering Bachelor of Technology (B.Tech) degree programs in the following disciplines:

1. Aeronautical Engineering
2. Computer Science and Engineering
3. Information Technology
4. Electronics and Communication Engineering
5. Electrical and Electronics Engineering
6. Mechanical Engineering
7. Civil Engineering

## 4. SEMESTER STRUCTURE

Each academic year is divided into three semesters, TWO being **MAIN SEMESTERS** (one odd + one even) and ONE being a **SUPPLEMENTARY SEMESTER**. Main semesters are for regular class work. Supplementary Semester is primarily for failed students i.e. registration for a course for the first time is generally not permitted in the supplementary semester.

4.1 Each main semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation, and conduct of examinations.

4.2 Each main semester shall have a minimum of 90 working days; out of which 75 days are for teaching / practical and 15 days for conduct of exams and preparation.

4.3 The supplementary semester shall be a fast track semester consisting of eight weeks and this period includes time for registration of courses, course work, and examination preparation, conduct of examinations, assessment, and declaration of final results.

4.4 All subjects may not be offered in the supplementary semester. The student has to pay a stipulated fee prescribed by the institute to register for a course in the supplementary semester. The supplementary semester is provided to help the student in not losing an academic year. It is optional for a student to make use of supplementary semester. **Supplementary semester is a special semester and the student cannot demand it as a matter of right** and will be offered based on availability of faculty and other institute resources.

4.5 The institute may use **supplementary semester** to arrange add-on courses for regular students and / or for deputing them for practical training / FSI model. A student can register for a maximum number of 15 credits during a supplementary semester.

4.5.1 The registration for the supplementary semester (during May – July, every year) provides an opportunity to students to clear their backlogs (‘F’ grade) or who are prevented from appearing for SEE examinations due to shortage of attendance less than 65% in each course (‘SA’ Grade) in the earlier semesters or the courses which he / she could not register (Drop / Withdraw) due to any reason.

Students will not be permitted to register for more than 15 credits (both I and II semester) in the supplementary semester. Students required to register for supplementary semester courses are to pay a nominal fee within the stipulated time. A separate circular shall be issued at the time of supplementary semester.

It will be optional for a student to get registered in the course(s) of supplementary semester; otherwise, he / she can opt to appear directly in supplementary examination. However, if a student gets registered in a course of supplementary semester, then it will be compulsory for a student to fulfill attendance criterion (≥90%) of supplementary semester and he / she will lose option to appear in immediate supplementary examination.

The students who have earlier taken SEE examination and register afresh for the supplementary semester may revoke the CIA marks secured by them in their regular/earlier attempts in the same course. Once revoked, the students shall not seek restoration of the CIA marks.

Supplementary semester will be at an accelerated pace e.g. one credit of a course shall require two hours/week so that the total number of contact hours can be maintained same as in normal semester.

**Instructions and guidelines for the supplementary semester course:**

- A minimum of 36 to 40 hours will be taught by the faculty for every course.
- Only the students registered and having sufficient percentage of attendance for the course will be permitted to write the examination.
- The assessment procedure in a supplementary semester course will be similar to the procedure for a regular semester course.
- Student shall register for the supplementary semester as per the schedule given in academic calendar.
- Once registered, students will not be allowed to withdraw from supplementary semester.

4.5.2 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

**Table 1: Academic Calendar**

<table>
<tr><td rowspan="6">FIRST SEMESTER (21 weeks)</td><td>I Spell Instruction Period</td><td>8 weeks</td><td rowspan="5">19 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td>Preparation and Practical Examinations</td><td>1 week</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 (21 weeks)</td><td>I Spell Instruction Period</td><td>8 weeks</td><td rowspan="5">19 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td>Preparation & Practical Examinations</td><td>1 week</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="3">Summer Vacation, Supplementary Semester and Remedial Exams</td><td>8 weeks</td></tr>
</table>

4.6 Students admitted on transfer from JNTUH affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned 'Board of Studies'.

## 5.0 REGISTRATION / DROPPING / WITHDRAWAL

5.1. Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is compulsory for the student to register for courses in time. The registration will be organized departmentally under the supervision of the Head of the Department.

5.2. In ABSENTIA, registration will not be permitted under any circumstances.

5.3. At the time of registration, students should have cleared all the dues of Institute and Hostel for the previous semesters, paid the prescribed fees for the current semester and not been debarred from the institute for a specified period on disciplinary or any other ground.

5.4. The student has to normally register for a minimum of 17 credits and may register up to a maximum of 27 credits, in consultation with HOD/faculty mentor. On an average, a student is expected to register for 22 credits.

5.5. **Dropping of Courses:** Within one week after the last date of first internal assessment test or by the date notified in the academic calendar, the student may in consultation with his / her faculty mentor/adviser, drop one or more courses without prejudice to the minimum number of credits as specified in clause 5.4. The dropped courses are not recorded in the Grade Card. Student must complete the dropped subject by registering in the supplementary semester / forthcoming semester in order to earn the required credits. Student must complete the dropped subject by registering in the supplementary semester / forthcoming semester in order to earn the required credits.

5.6. **Withdrawal from Courses:** A student is permitted to withdraw from a course by the date notified in the academic calendar. Such withdrawals will be permitted without prejudice to the minimum number of credits as specified in clause 5.4. A student cannot withdraw a course more than once and withdrawal of reregistered subjects is not permitted.

5.7 After **Dropping and / or Withdrawal** of courses, minimum credits registered shall be 20.

## 6.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the seven groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

**Table 2: Group of Courses**

| S. No | Branch | Code |
|---|---|---|
| 1 | Aeronautical Engineering | AE |
| 2 | Computer Science and Engineering | CS |
| 3 | Information Technology | IT |
| 4 | Electronics and Communication Engineering | EC |
| 5 | Electrical and Electronics Engineering | EE |
| 6 | Mechanical Engineering | ME |
| 7 | Civil Engineering | CE |

## 7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Theory Courses, Elective Courses, Laboratory Courses, Audit Courses, Mandatory Courses, Mini Project, Internship and Project work. The list of elective courses may also include subjects from allied discipline.

**Contact Periods:** Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours/week as follows:

- **Contact classes (Theory):** 1 credit per lecture hour per week, 1 credit per tutorial hour per week.
- **Laboratory Hours (Practical):** 1 credit for 2 practical hours per week.
- **Project Work:** 1 credit for 2 hours of project work per week.
- **Mini Project:** 1 credit for 2 hours per week

### 7.1 TYPES OF COURSES

Courses in a program may be of three kinds: **Foundation / Skill, Core and Elective Courses.**

#### 7.1.0 Foundation / Skill Course:

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamental to learning any subject.

#### 7.1.1 Professional Core Courses:

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

#### 7.1.2 Elective Course:

Electives provide breadth of experience in respective branch and application 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 Professional Elective, is a discipline centric focusing on those courses which add generic proficiency to the students or may be Open Elective, chosen from unrelated disciplines.

There are six professional elective tracks; students can choose not more than two courses from each track. Overall, students can opt for six professional elective courses which suit their project work in consultation with the faculty advisor/mentor. Nevertheless, one course from each of the four open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

### 7.1.3 Credit distribution for courses offered is given in Table 3.

**Table 3: Credit distribution**

| S. No | Course | Hours | Credits |
|---|---|---|---|
| 1 | Theory Course | 1 / 2 / 3 / 4 | 1 / 2 / 3 / 4 |
| 2 | Elective Courses | 3 | 3 |
| 3 | MOOC Courses | - | 2 |
| 4 | Laboratory Courses | 2 / 3 / 4 | 1 / 1.5 / 2 |
| 5 | Audit Course / Mandatory Course | - | 0 |
| 6 | Project / Research based learning | - | 4 |
| 7 | Full Semester Internship (FSI) / Project Work | - | 11 |

## 7.2 Course Structure

Every course of the B.Tech program will be placed in one of the eight categories with minimum credits as listed in the Table 4.

**Table 4: Category Wise Distribution of Credits**

| S. No | Category | Breakup of Credits |
|---|---|---|
| 1 | Humanities and Social Sciences (HSMC), including Management. | 12 |
| 2 | Basic Science Courses (BSC) including Mathematics, Physics and Chemistry. | 25 |
| 3 | Engineering Science Courses (ESC), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering. | 24 |
| 4 | Professional Core Courses (PCC), relevant to the chosen specialization / branch. | 48 |
| 5 | Professional Electives Courses (PEC), relevant to the chosen specialization / branch. | 18 |
| 6 | Open Elective Courses (OEC), from other technical and/or emerging subject areas. | 18 |
| 7 | Project Based Learning, Research Based Learning and Project Work (PROJ) / Full Semester Internship (FSI) | 15 |
| 8 | Mandatory Courses / Audit Courses. | Non-Credit |
| **TOTAL** | | **160** |

## 7.3 Semester wise course break-up

Following are the **TWO** models of course structure out of which any student shall choose or will be allotted with one model based on their academic performance.

i. Full Semester Internship (FSI) Model and

ii. Non Full Semester Internship (NFSI) Model – Project work.

## 7.4 For Four year regular program (FSI Model):

In the FSI Model, out of the selected students - half of students shall undergo Full Semester Internship in VII semester and the remaining students in VIII semester. In the Non FSI Model, all the selected students shall carry out the course work and Project work as specified in the course

structure. A student who secures a minimum CGPA of 7.5 up to IV semester with no current arrears and maintains the CGPA of 7.5 till VI Semester shall be eligible to opt for FSI.

# 8.0 EVALUATION METHODOLOGY

## 8.1 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 CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

### 8.1.1 Semester End Examination (SEE):

The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each modules carries equal weightage in terms of marks distribution. The question paper pattern is as follows.

Two full questions with 'either' 'or' choice will be drawn from each module. Each question carries 14 marks. There could be a maximum of two 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 |
| 50 % | To test the analytical skill of the concept OR to test the application skill of the concept |

### 8.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty / teacher handling the course as given in Table 5. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

**Table 5: Assessment pattern for Theory Courses**

| COMPONENT | THEORY | | | TOTAL MARKS |
|---|---|---|---|---|
| **Type of Assessment** | CIE Exam | Quiz | AAT | |
| **Max. CIA Marks** | 20 | 05 | 05 | 30 |

#### 8.1.2.1 Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8$^{th}$ and 16$^{th}$ week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

#### 8.1.2.2 Quiz – Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

#### 8.1.2.3 Alternative Assessment Tool (AAT)

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, **METE** (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

However, it is mandatory for a faculty to obtain prior permission from the concerned HOD and spell out the teaching/assessment pattern of the AAT prior to commencement of the classes.

## 8.2 Laboratory Course:

8.2.1 Each laboratory 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 Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by the Chairman, BOS.

8.2.2 All the drawing related courses are evaluated in line with laboratory 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 of 10 marks in each semester.

## 8.3 Mandatory Courses (MC):

These courses are among the compulsory courses but will not carry any credits. However, a pass in each such course during the program shall be necessary requirement for the student to qualify for the award of Degree. Its result shall be declared as “Satisfactory” or “Not Satisfactory” performance.

## 8.4 Value Added Courses:

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

## 8.5 Project / Research Based Learning

This gives students a platform to experience a research driven career in engineering, while developing a device / systems and publishing in reputed SCI / SCOPUS indexed journals and/or filing an **Intellectual Property** (IPR-Patent/Copyright) to aid communities around the world. Students should work individually as per the guidelines issued by head of the department concerned. The benefits to students of this mode of learning include increased engagement, fostering of critical thinking and greater independence.

The topic should be so selected that the students are enabled to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of the work be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome.

Project report will be evaluated for 100 marks in total. Assessment will be done for 100 marks out of which, the supervisor / guide will evaluate for 30 marks based on the work and presentation / execution of the work. Subdivision for the remaining 70 marks is based on publication, report, presentation, execution and viva-voce. Evaluation shall be done by a committee comprising the supervisor, Head of the department and an examiner nominated by the Principal from the panel of experts recommended by Chairman, BOS in consultation with Head of the department.

## 8.6 Project work

The project work shall be evaluated for 100 marks out of which 30 marks for internal evaluation and 70 marks for semester end evaluation. The project work shall be spread over in VII semester and in VIII semester. The project work shall be somewhat innovative in nature and explore the research bent of the mind of the student. A student shall carry out the project work under the supervision of a member of the faculty or may undertake to execute the project in collaboration with an Industry, R&D organization or another academic institution/University where sufficient facilities exist to carry out the project work.

At the end of VII semester, students should submit synopsis summarizing the work done in VII semester. The project is expected to be completed by the end of VIII semester. In VII semester, a first mid review is conducted by Project Review Committee (PRC) (on the progress) for 10 marks.

In VIII semester, a second mid review is conducted by PRC (on the progress) for 10 marks. On completion of the project, a third evaluation is conducted for award of internal marks of another 10 marks before the report is submitted, making the total internal marks 30.

The end semester examination shall be based on the report submitted and a viva-voce exam for 70 marks by a committee comprising the Head of the Department, the project supervisor and an external examiner nominated by the Principal. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

## 8.7 Full Semester Internship (FSI)

FSI is a full semester internship program carrying 11 credits. The FSI shall be opted in VII semester or in VIII semester. During the FSI, student has to spend one full semester in an identified industry / firm / R & D organization or another academic institution/University where sufficient facilities exist to carry out the project work.

**Following are the evaluation guidelines:**

- Quizzes: 2 times
- Quiz #1 - About the industry profile, weightage: 5%
- Quiz #2 - Technical-project related, weightage: 5%
- Seminars - 2 times (once in six weeks), weightage: 7.5% + 7.5%
- Viva-voce: 2 times (once in six weeks), weightage: 7.5% + 7.5%
- Project Report, weightage: 15%
- Internship Diary, weightage: 5 %
- Final Presentation, weightage: 40%

FSI shall be open to all the branches with a ceiling of maximum 10% distributed in both semesters. The selection procedure is:

- Choice of the students
- CGPA (> 7.5) up to IV semester
- Competency Mapping / Allotment

## 9.0 MAKEUP EXAMINATION

The make-up examination facility shall be available to students who may have missed to attend CIE exams in one or more courses in a semester for valid genuine reasons. The make-up examination shall have comprehensive online objective type questions. The syllabus for the make-up examination shall be the whole syllabus covered till the end of the semester under consideration and will be conducted at the end of the semester.

## 10.0 SUPPLEMENTARY EXAMINATIONS:

In addition to the Regular Semester End Examinations held at the end of each semester, Supplementary Semester End Examinations will be conducted within three weeks of the commencement of the teaching of the next semester. Candidates taking the Regular / Supplementary examinations as Supplementary candidates may have to take more than one Semester End Examination per day. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However the maximum stipulated period for the course shall not be relaxed under any circumstances.

## 11.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

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

11.2 In case of medical issues, deficiency of attendance in each course to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of the Head of the Department if the attendance is between 75% and 65% in every course, subjected to the submission of medical certificates, medical case file, and other needful documents to the concerned departments.

11.3 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. 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.

11.4 A candidate shall put in a minimum required attendance in atleast 60% of (rounded to the next highest integer) courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

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

11.6 A prescribed fee shall be payable towards condonation of shortage of attendance.

11.7 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 fails to fulfill the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

11.8 Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

## 12.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

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

12.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by a Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations. Internal Examiner shall prepare a detailed scheme of valuation.

12.3 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.

12.4 In case of difference of 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 this examiner shall be taken as final.

12.5 COE 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.

12.6 Examinations Control Committee shall consolidate the marks awarded by internal and external examiners and award grades.

## 13.0 SCHEME FOR THE AWARD OF GRADE

13.1 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 35% marks for each theory course in the semester end examination, and

ii. A minimum of 40% marks for each theory course considering both internal and semester end examination.

13.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Project based learning / Research based learning / Project work / FSI, if s/he secures

i. Not less than 40% marks for each Lab / Project based learning / Research based learning / Project work / FSI course in the semester end examination,

ii. A minimum of 40% marks for each Lab / Project based learning / Research based learning / Project work / FSI course considering both internal and semester end examination.

13.3 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.

## 14.0 LETTER GRADES AND GRADE POINTS

14.1 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 in the Table-6.

**Table-6: Grade Points Scale (Absolute Grading)**

| Range of Marks | Grade Point | Letter Grade |
|---|---|---|
| 100 – 90 | 10 | S (Superior) |
| 89 – 80 | 9 | A+ (Excellent) |
| 79 – 70 | 8 | A (Very Good) |
| 69 – 60 | 7 | B+ (Good) |
| 59 – 50 | 6 | B (Average) |
| 49 – 40 | 5 | C (Pass) |
| Below 40 | 0 | F (Fail) |
| Absent | 0 | AB (Absent) |
| Authorized Break of Study | 0 | ABS |

14.2 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", "C".

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

14.4 For non credit courses, 'Satisfactory' or "Not Satisfactory" is indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

14.5 "SA" denotes shortage of attendance (as per item 11) and hence prevention from writing Semester End Examination.

14.6 "W" denotes **withdrawal** from the exam for the particular course.

14.7 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.

## 15.0 COMPUTATION OF SGPA AND CGPA

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

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

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

## 16.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

### 16.1 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 | S | 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** |

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

### 16.2 Illustration for CGPA

| Semester 1 | Semester 2 | Semester 3 | Semester 4 |
|---|---|---|---|
| Credit: 20<br>SGPA: 6.9 | Credit: 22<br>SGPA: 7.8 | Credit: 25<br>SGPA: 5.6 | Credit: 26<br>SGPA: 6.0 |
| **Semester 5** | **Semester 6** | | |
| Credit: 26<br>SGPA: 6.3 | Credit: 25<br>SGPA: 8.0 | | |

$$Thus,\ CGPA = \frac{20x6.9 + 22x7.8 + 25x5.6 + 26x6.0 + 26x6.3 + 25x8.0}{144} = 6.73$$

## 17.0 PHOTOCOPY / REVALUATION

A student, who seeks the re-valuation 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.

## 18.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 11.

### 18.1 For students admitted into B.Tech (Regular) program

18.1.1 A student will not be promoted from II semester to III semester unless s/he fulfills the academic requirement of securing 50% of the total credits (rounded to the next highest integer) from I and II semester examinations, whether the candidate takes the examination(s) or not.

18.1.2 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 50% of the total credits (rounded to the next highest integer) upto III semester **or** 50% of the total credits (rounded to the next highest integer) up to IV semester, from all the examinations, whether the candidate takes the examination(s) or not.

18.1.3 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 50% of the total credits (rounded to the next highest integer) up to V semester **or** 50% of the total credits (rounded to the next highest integer) up to VI semester from all the examinations, whether the candidate takes the examination(s) or not.

18.1.4 A student shall register for all the 160 credits and earn all the 160 credits. Marks obtained in all the 160 credits shall be considered for the award of the Grade.

### 18.2 For students admitted into B.Tech (lateral entry students)

18.2.1 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 50% of the total credits (rounded to the next highest integer) up to IV semester, from all the examinations, whether the candidate takes the examination(s) or not.

18.2.2 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 50% of the total credits (rounded to the next highest integer) up to V semester **or** 50% of the total credits (rounded to the next highest integer) up to VI semester from all the examinations, whether the candidate takes the examination(s) or not.

18.2.3 A student shall register for all the 123 credits and earn all the 123 credits. Marks obtained in all the 123 credits shall be considered for the award of the Grade.

## 19.0 GRADUATION REQUIREMENTS

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

19.1 Student shall register and acquire minimum attendance in all courses and secure 160 credits for regular program and 123 credits for lateral entry program.

19.2 A student of a regular program, who fails to earn 160 credits within eight consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

19.3 A student of a lateral entry program who fails to earn 123 credits within six consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

## 20.0 BETTERMENT OF MARKS IN THE COURSES ALREADY PASSED

Students who clear all the courses in their first attempt and wish to improve their CGPA shall register and appear for betterment of marks for one course of any theory courses within a period of subsequent two semesters. The improved marks shall be considered for classification / distinction but not for ranking. If there is no improvement, there shall not be any change in the original marks already awarded.

## 21.0 AWARD OF DEGREE

21.1 Classification of degree will be as follows:

| CGPA ≥ 7.5 | CGPA ≥ 6.5 and < 7.5 | CGPA ≥ 5.0 and < 6.5 | CGPA ≥ 4.0 and < 5.0 | CGPA < 4.0 |
|---|---|---|---|---|
| **First Class with Distinction** | **First Class** | **Second Class** | **Pass Class** | **Fail** |

21.2 In order to extend the benefit to the students with one/two backlogs after either VI semester or VIII semester, GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

a. Grafting will be done among the courses within the semester shall draw a maximum of 7 marks from the any one of the cleared courses in the semester and will be grafted to the failed course in the same semester.
b. Students shall be given a choice of grafting only once in the 4 years program, either after VI semester (Option #1) or after VIII semester (Option #2).
c. Option#1: Applicable to students who have maximum of TWO theory courses in V and / or VI semesters.
   Option#2: Applicable to students who have maximum of TWO theory courses in VII and / or VIII semesters.
d. Eligibility for grafting:
   i. Prior to the conduct of the supplementary examination after the declaration of VI or VIII semester results.
   ii. S/he must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses s/he appeals for grafting.
   iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s).

21.3 Student, who clears all the courses upto VII semester, shall have a chance to appear for Quick Supplementary Examination to clear the failed courses of VIII semester.

21.4 By the end of VI semester, all the students (regular and lateral entry students) shall complete one of the audit course and mandatory course with acceptable performance.

21.5 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.

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 and consolidated grade sheet subject to the fulfillment of all the academic requirements.

## 22 B.TECH WITH HONOURS OR ADDITIONAL MINORS IN ENGINEERING

Students acquiring 160 credits are eligible to get B.Tech degree in Engineering. A student will be eligible to get B.Tech degree with Honours or additional Minors in Engineering, if s/he completes an additional 20 credits (3/4 credits per course). These could be acquired through MOOCs from SWAYAM / NPTEL / edX / Coursera / Udacity /PurdueNext / Khan Academy / QEEE etc. The list for MOOCs will be a dynamic one, as new courses are added from time to time. Few essential skill sets required for employability are also identified year wise. 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. Any expense incurred for the MOOC course / summer program should be met by the students.

Only students having no credit arrears and a CGPA of 7.5 or above at the end of the fourth semester are eligible to register for B.Tech (Honours / Minor). After registering for the B.Tech (Honours / Minor) program, if a student fails in any course, s/he will not be eligible for B.Tech (Honours / Minor).

Every Department to develop and submit a Honours / Minors – courses list of 5 - 6 theory courses.

**Honours Certificate for Vertical in his/her OWN Branch for Research orientation; Minor in any OTHER branch for Improving Employability.**

For the MOOCs platforms, where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the institute prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that examinations Control Office (ECO) can conduct examination for the course. There shall be one Continuous Internal

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

A student can enroll for both Minor & Honours or for two Minors. The final grade sheet will only show the basic CGPA corresponding to the minimum requirement for the degree. The Minors/Honours will be indicated by a separate CGPA. The additional courses taken will also find separate mention in the grade sheet.

If a student drops (or terminated) from the Minor/Honours program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the grade sheet (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "Pass (P)" grade and also choose to omit the mention of the course as for the following:

- All the courses done under the dropped Minor/Honours will be shown in the grade sheet
- None of the courses done under the dropped Minor/Honours will be shown in the grade sheet.

Honours will be reflected in the degree certificate as "B.Tech (honours) in XYZ Engineering". Similarly, Minor as "B.Tech in XYZ Engineering with Minor in ABC". If a student has done both honours & minor, it will be acknowledged as "B.Tech (honours) in XYZ Engineering with Minor in ABC". And two minors will be reflected as "B.Tech in XYZ Engineering with Minor in ABC and Minor in DEF".

### 22.1. B.Tech with Honours

The total of 20 credits required to be attained for B.Tech Honours degree are distributed from V semester to VII semester in the following way:

| | | |
|---|---|---|
| For V semester | : | 4 – 8 credits |
| For VI semester | : | 4 – 8 credits |
| For VII semester | : | 4 – 8 credits |

**Following are the details of such Honours which include some of the most interesting areas in the profession today:**

| S. No | Department | Honours scheme |
|---|---|---|
| 1 | Aeronautical Engineering | Aerospace Engineering / Space Science etc. |
| 2 | Computer Science and Engineering / Information Technology | Big data and Analytics / Cyber Physical Systems, Information Security / Cognitive Science / Internet of Things (IoT) etc. |
| 3 | Electronics and Communication Engineering | Digital Communication / Signal Processing / Communication Networks / VLSI Design / Embedded Systems etc. |
| 4 | Electrical and Electronics Engineering | Renewable Energy systems / Energy and Sustainability / IoT Applications in Green Energy Systems etc. |
| 5 | Mechanical Engineering | Industrial Automation and Robotics / Manufacturing Sciences and Computation Techniques etc. |
| 6 | Civil Engineering | Structural Engineering / Environmental Engineering etc. |

### 22.2 B.Tech with additional Minor in Engineering

Every Department to develop and submit Minor Courses List of 5 - 6 Theory courses. Student from any department is eligible to apply for Minor from any other department. The total of 20 credits to complete the B.Tech (Minor) program by registering for MOOC courses each having a minimum of 3/4 credits offered by reputed institutions / organization with the approval of the department. Registration of the student for B.Tech (Minor), is from V Semester to VII Semester of the program in the following way:

| | | |
|---|---|---|
| For V semester | : | 4 – 8 credits |
| For VI semester | : | 4 – 8 credits |
| For VII semester | : | 4 – 8 credits |

Only students having no credit arrears and a CGPA of 7.5 or above at the end of the fourth semester are eligible to register for B.Tech (Minor). After registering for the B.Tech (Minor) program, if a student fails in any course, s/he will not be eligible for B.Tech (Minor).

Every student shall also have the option to do a minor in engineering. A major is a primary focus of study and a minor is a secondary focus of study. The minor has to be a subject offered by a department other than the department that offers the major of the student or it can be a different major offered by the same department. For example, a student with the declared major in Computer Science and Engineering (CSE) may opt to do a minor in Physics; in which case, the student shall receive the degree B.Tech, Computer Science and Engineering with a minor in Physics. A student can do Majors in chosen filed as per the career goal, and a minor may be chosen to enhance the major thus adding the diversity, breadth and enhanced skills in the field.

### Advantages of Minor in Engineering:

The minors mentioned above are having lots of advantages and a few are listed below:

1. To apply the inter-disciplinary knowledge gained through a Major (Stream) + Minor.
2. To enable students to pursue allied academic interest in contemporary areas.
3. To provide an academic mechanism for fulfilling multidisciplinary demands of industries.
4. To provide effective yet flexible options for students to achieve basic to intermediate level competence in the Minor area.
5. Provides an opportunity to students to become entrepreneurs and leaders by taking business/ management minor.
6. Combination in the diverse fields of engineering e.g., CSE (Major) + Electronics (Minor) combination increases placement prospects in chip designing companies.
7. Provides an opportunity to Applicants to pursue higher studies in an inter-disciplinary field of study.
8. Provides opportunity to the Applicants to pursue interdisciplinary research.
9. To increase the overall scope of the undergraduate degrees.

### Following are the details of such Minor / Honours which include some of the most interesting areas in the profession today:

1. Space Science
2. Information Security
3. Data Analytics
4. Cyber Physical Systems
5. Electronic System Design
6. Renewable Energy Sources
7. Energy and Sustainability
8. Industrial Automation and Robotics
9. Aerospace Engineering
10. Manufacturing Sciences and Computation Techniques
11. Structural Engineering
12. Environmental Engineering
13. Internet of Things

14. Computer Science and Engineering
15. Technological Entrepreneurship
16. Materials Engineering
17. Physics (Materials / Nuclear / Optical / Medical)
18. Mathematics (Combinatorics / Logic / Number theory / Dynamical systems and differential equations./ Mathematical **physics /** Statistics and Probability).

## 23.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAM

23.1 A candidate is normally not permitted to take a break from the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the program in a later respective semester, s/he shall seek the approval from the Principal in advance. Such application shall be submitted before the last date for payment of examination fee of the semester in question and forwarded through the Head of the Department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

23.2 The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to temporarily withdraw from the program. Such permission is accorded only to those who do not have any outstanding dues / demand at the College / University level including tuition fees, any other fees, library materials etc.

23.3 The candidate has to rejoin the program after the break from the commencement of the respective semester as and when it is offered.

23.4 The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in clause 19. The maximum period includes the break period.

23.5 If any candidate is detained for any reason, the period of detention shall not be considered as 'Break of Study'.

## 24.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student is 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. A student shall not be permitted to study any semester more than three times during the entire program of study.
c. The student fails to satisfy the norms of discipline specified by the institute from time to time.

## 25.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him, the results and the degree of the candidate will be withheld.

## 26.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of degrees to the 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 and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

## 27.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and are expected not to indulge in any activity which will tend to bring down the honour 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.

## 28.0 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.

## 29.0 TRANSITORY REGULATIONS

A candidate, who is detained or has discontinued a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

### a) Four Year B.Tech Regular course:

A student who is following Jawaharlal Nehru Technological University (JNTUH) curriculum and detained due to the shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUH curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

### b) Three Year B.Tech program under Lateral Entry Scheme:

A student who is following JNTUH curriculum and detained due to the shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUH curriculum, if detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption

will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

**c) Transfer candidates (from non-autonomous college affiliated to JNTUH):**

A student who is following JNTUH curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits up to the previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

**d) Transfer candidates (from an autonomous college affiliated to JNTUH):**

A student who has secured the required credits up to previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

**e) Readmission from IARE-R16 to IARE-R18 regulations**

A student took admission in IARE-R16 Regulations, detained due to lack of required number of credits or percentage of attendance at the end of any semester is permitted to take re-admission at appropriate level under any regulations prevailing in the institute subject to the following rules and regulations.

1. Student shall pass all the courses in the earlier scheme of regulations (IARE - R16). However, in case of having backlog courses, they shall be cleared by appearing for supplementary examinations conducted under IARE - R16 regulations from time to time.
2. After rejoining, the student is required to study the courses as prescribed in the new regulations for the re-admitted program at that level and thereafter.

3. If the student has already passed any course(s) of readmitted program in the earlier regulation / semester of study, such courses are exempted in the new scheme to appear for the course(s).
4. The courses that are not done in the earlier regulations / semester as compared with readmitted program need to be cleared after readmission by appearing for the examinations conducted time to time under the new regulations.
5. In general, after transition, course composition and number of credits / semester shall be balanced between earlier and new regulations on case to case basis.
6. In case, the students who do not have option of acquiring required credits with the existing courses offered as per the new curriculum, credit balance can be achieved by clearing the additional courses offered by the respective departments (approved in Academic Council meeting). The additional courses that are offered can be of theory or laboratory courses and shall be offered during semester.
7. Students re-joined in III semester shall be treated on par with "Lateral Entry" students for credits and graduation requirements. However, the student shall clear all the courses in B.Tech I Semester and B.Tech II Semester as per IARE-R16 regulations.

## 30.0 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 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)**

Dundigal, Hyderabad – 500043

## AERONAUTICAL 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** | | | | | | | | | | |
| AHSB02 | Linear Algebra and Calculus | BSC | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AHSB04 | Waves and Optics | BSC | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| ACSB01 | Programming for Problem Solving | ESC | Foundation | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| AHSB10 | Engineering Physics Laboratory | BSC | Foundation | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| ACSB02 | Programming for Problem Solving Laboratory | ESC | Foundation | 0 | 0 | 4 | 2 | 30 | 70 | 100 |
| AMEB01 | Workshop / Manufacturing Practices Laboratory | ESC | Foundation | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| **TOTAL** | | | | **09** | **02** | **10** | **16** | **180** | **420** | **600** |

### 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** | | | | | | | | | | |
| AHSB01 | English | HSMC | Foundation | 2 | 0 | 0 | 2 | 30 | 70 | 100 |
| AHSB11 | Mathematical Transform Techniques | BSC | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AHSB03 | Engineering Chemistry | BSC | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AMEB03 | Engineering Mechanics | ESC | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| AHSB08 | English Language and Communication Skills Laboratory | HSMC | Foundation | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| AHSB09 | Engineering Chemistry Laboratory | BSC | Foundation | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| AMEB02 | Engineering Graphics and Design Laboratory | ESC | Foundation | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| AAEB01 | Basic Simulation with MAT Laboratory | ESC | Foundation | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| **TOTAL** | | | | **12** | **03** | **12** | **21** | **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** | | | | | | | | | | |
| AAEB02 | Engineering Thermodynamics | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| AEEB04 | Basic Electrical and Electronics Engineering | PCC | Core | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AHSB12 | Probability and Statistics | BSC | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AAEB03 | Fluid Dynamics | PCC | Core | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AAEB04 | Mechanics of Solids | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| AAEB05 | Fluid Dynamics Laboratory | PCC | Core | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| AAEB06 | Mechanics of Solids Laboratory | PCC | Core | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| AITB08 | Object Oriented Programming through Python Laboratory | PCC | Core | 1 | 0 | 2 | 2 | 30 | 70 | 100 |
| **TOTAL** | | | | **16** | **03** | **06** | **22** | **240** | **560** | **800** |

## IV SEMESTER

| Course Code | Course Name | Subject Area | Category | Periods per week | | | Credits | Scheme of Examination Max. Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | CIA | SEE | Total |
| **THEORY** | | | | | | | | | | |
| AAEB07 | Aerospace Structures | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| ACSB03 | Data structures | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| AAEB08 | Aerospace Propulsion | PCC | Core | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AAEB09 | Flight Mechanics | PCC | Core | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AAEB10 | Aerodynamics | PCC | Core | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| AHSB07 | Environmental Science | MC-II | --- | 0 | 0 | 0 | 0 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| AAEB11 | Aerospace Structures Laboratory | PCC | Core | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| AAEB12 | Aerodynamics and Propulsion Laboratory | PCC | Core | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| ACSB05 | Data structures Laboratory | PCC | Core | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| **TOTAL** | | | | **15** | **03** | **08** | **22** | **270** | **630** | **900** |

## V SEMESTER

| Course Code | Course Name | Subject Area | Category | Periods per week | | | Credits | Scheme of Examination Max. Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | CIA | SEE | Total |
| **THEORY** | | | | | | | | | | |
| | Aircraft stability and control | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Analysis of Aircraft Structures | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | High speed Aerodynamics | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Professional Elective - I | PEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Professional Elective - II | PEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Open Elective - I | OEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| | Computer aided design Laboratory | PCC | Core | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| | Composite structures laboratory | PCC | Core | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| | Project based Learning (Prototype / Design Building) | PROJ | Project | 0 | 0 | 4 | 2 | 30 | 70 | 100 |
| **TOTAL** | | | | **18** | **00** | **08** | **22** | **270** | **630** | **900** |

## VI SEMESTER

| Course Code | Course Name | Subject Area | Category | Periods per week | | | Credits | Scheme of Examination Max. Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | CIA | SEE | Total |
| **THEORY** | | | | | | | | | | |
| | Finite Element methods | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Computational Aerodynamics | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Aircraft Systems | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Professional Elective - III | PEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Professional Elective - IV | PEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Open Elective - II | OEC (HSMC) | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| | Computational Aerodynamics Laboratory | PCC | Core | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| | Computational Structures Laboratory | PCC | Core | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| | Research Based Learning (Fabrication / Model Development) | PROJ | Project | 0 | 0 | 4 | 2 | 30 | 70 | 100 |
| **TOTAL** | | | | **18** | **00** | **08** | **22** | **270** | **630** | **900** |

## VII SEMESTER

| Course Code | Course Name | Subject Area | Category | Periods per week | | | Credits | Scheme of Examination Max. Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | CIA | SEE | Total |
| **THEORY** | | | | | | | | | | |
| | Flight Vehicle Design | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Aerospace Structural Dynamics | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Professional Elective – V | PEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Professional Elective - VI | PEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Open Elective - III | OEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Essence of Indian Traditional Knowledge | MC- III | --- | 0 | 0 | 0 | 0 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| | Flight Vehicle Design Laboratory | PCC | Core | 0 | 0 | 2 | 1.5 | 30 | 70 | 100 |
| | Aerospace Structural Dynamics Lab | PCC | Core | 0 | 0 | 2 | 1.5 | 30 | 70 | 100 |
| | Project work – I | PROJ | Project | 0 | 0 | 10 | 5 | 30 | 70 | 100 |
| **TOTAL** | | | | **15** | **00** | **14** | **23** | **270** | **630** | **900** |

## VIII SEMESTER

| Course Code | Course Name | Subject Area | Category | Periods per week | | | Credits | Scheme of Examination Max. Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | CIA | SEE | Total |
| **THEORY** | | | | | | | | | | |
| | Aviation Management | PCC | Core | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| | Open Elective - IV | OEC | Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| | Project Work – II / Full Semester Internship | PROJ | Project | 0 | 0 | 12 | 6 | 30 | 70 | 100 |
| **TOTAL** | | | | **06** | **00** | **12** | **12** | **90** | **210** | **300** |

## PROFESSIONAL ELECTIVES COURSES

### TRACK – I

| Course Code | Course Title |
|---|---|
| 1 | Advanced solid mechanics |
| 2 | Space Propulsion |
| 3 | Helicopter Engineering |

### TRACK - II

| Course Code | Course Title |
|---|---|
| 1 | Air transportation Systems |
| 2 | Cryogenic engines |
| 3 | Fatigue and facture mechanics |

### TRACK – III

| Course Code | Course Title |
|---|---|
| 1 | Analysis of composite structures |
| 2 | Space mechanics |
| 3 | CAD / CAM |

### TRACK – IV

| Course Code | Course Title |
|---|---|
| 1 | Airport Planning and Management |
| 2 | Experimental Aerodynamics |
| 3 | Launch vehicles and Missiles |

### TRACK – V

| Course Code | Course Title |
|---|---|
| 1 | Orbital Mechanics |
| 2 | Unmanned Air Vehicles |
| 3 | Avionics and Instrumentation |

### TRACK – VI

| Course Code | Course Title |
|---|---|
| 1 | Airframe Structural Design |
| 2 | Advanced computational Aerodynamics |
| 3 | Aero Elasticity |

# OPEN ELECTIVES COURSES

## OPEN ELECTIVE – I

| Course Code | Course Title |
|---|---|
| 1 | Micro Processors and Micro Controllers |
| 2 | Operations Research |
| 3 | Python Programming |
| 4 | Modern Manufacturing Processes |

## OPEN ELECTIVE – II

| Course Code | Course Title |
|---|---|
| 1 | Automobile Engineering |
| 2 | Business Economics and Financial Analysis |
| 3 | Internet of Things |
| 4 | Digital Image Processing |

## OPEN ELECTIVE – III

| Course Code | Course Title |
|---|---|
| 1 | Introduction to Robotics |
| 2 | Data Management system |
| 3 | Embedded Systems |
| 4 | Energy from Waste management |

## OPEN ELECTIVE – IV

| Course Code | Course Title |
|---|---|
| 1 | Big Data Analysis |
| 2 | Nanotechnology |
| 3 | Non conventional Energy resources utilization |
| 4 | Machine learning |

## MANDATORY COURSES

| Course Code | Course Title |
|---|---|
| 1 | Environmental Science |
| 2 | Biology |
| 3 | Essence of Indian Traditional Knowledge |
| 4 | Universal Human Values – I |
| 5 | Learning an Art Form |

# SYLLABUS

# LINEAR ALGEBRA AND CALCULUS

**I Semester: AE / CSE / IT / ECE / EEE / ME / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB02 | Foundation | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Analyze and solve linear system of equations by using elementary transformations.
II. Determine the maxima and minima of functions of several variables by using partial differential coefficients.
III. Apply Differential equations on real time applications.
IV. Apply multiple integration to evaluate mass area volume of the plane.
V. Analyze gradient, divergent and curve to evaluate the integration over a vector field.

| MODULE - I | THEORY OF MATRICES AND LINEAR TRANSFORMATIONS | Classes: 09 |
|---|---|---|

Real matrices: Symmetric, skew-symmetric and orthogonal matrices; Complex matrices: Hermitian, Skew-Hermitian and unitary matrices; Elementary row and column transformations; Rank of a matrix: Echelon form and normal form; Inverse by Gauss-Jordan method; Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Eigen values and Eigen vectors of a matrix and Properties (without proof); Diagonalization of matrix by linear transformation.

| MODULE - II | FUNCTIONS OF SINGLE AND SEVERAL VARIABLES | Classes: 09 |
|---|---|---|

Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof; Functions of several variables: Partial differentiation, chain rule, total derivative, Euler's theorem, functional dependence, Jacobian, maxima and minima of functions of two variables without constraints and with constraints; Method of Lagrange multipliers.

| MODULE - III | HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS | Classes: 09 |
|---|---|---|

Linear differential equations of second and higher order with constant coefficients, non-homogeneous term of the type $f(x)=e^{ax}, \sin ax, \cos ax$ and $f(x)=x^n, e^{ax}v(x), x^n v(x)$; Method of variation of parameters; Applications to electrical circuits.

| MODULE - IV | MULTIPLE INTEGRALS | Classes: 09 |
|---|---|---|

Double and triple integrals; Change of order of integration.

Transformation of coordinate system; Finding the area of a region using double integration and volume of a region using triple integration.

| MODULE - V | VECTOR CALCULUS | Classes: 09 |
|---|---|---|

Scalar and vector point functions; Definitions of Gradient, divergent and curl with examples; Solenoidal and irrotational vector point functions; Scalar potential function; Line integral, surface integral and volume integral; Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem without proofs.

**Text Books:**

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36th Edition, 2010.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2010.

**Reference Books:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition, 2006.
2. Veerarajan T., "Engineering Mathematics for First Year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", Brooks/Cole, 2nd Edition, 2005.
4. Dr. M Anita, "Engineering Mathematics-I", Everest Publishing House, Pune, 1st Edition, 2016.

**Web References:**

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://www.mathworld.wolfram.com/

**E-Text Books:**

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

# WAVES AND OPTICS

**I Semester: AE / ECE / ME | II Semester: EEE / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB04 | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| Contact Classes:45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Enrich knowledge in principals of quantum mechanics and semiconductors.
II. Correlate principles and applications of lasers and fiber optics.
III. Acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature.
IV. Develop strong fundamentals of transverse, longitudinal waves and harmonic waves.

| MODULE - I | QUANTUM MECHANICS | Classes: 08 |
|---|---|---|

Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, De-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Time-independent Schrodinger equation for wave function, Born interpretation of the wave function, Schrodinger equation for one dimensional problems–particle in a box.

| MODULE - II | INTRODUCTION TO SOLIDS AND SEMICONDUCTORS | Classes: 10 |
|---|---|---|

Bloch's theorem for particles in a periodic potential, Kronig-Penney model (Qualitative treatment), Origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators; Intrinsic and extrinsic semiconductors, Carrier concentration, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Hall effect.

| MODULE - III | LASERS AND FIBER OPTICS | Classes: 10 |
|---|---|---|

Characteristics of lasers, Spontaneous and stimulated emission of radiation, Metastable state, Population inversion, Lasing action, Ruby laser, He-Ne laser and applications of lasers.

Principle and construction of an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Attenuation in optical fibers, Optical fiber communication system with block diagram.

| MODULE - IV | LIGHT AND OPTICS | Classes: 07 |
|---|---|---|

Huygens' principle, Superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer; Fraunhofer diffraction from a single slit, circular aperture and diffraction grating.

| MODULE - V | HARMONIC OSCILLATIONS AND WAVES IN ONE DIMENSION | Classes: 10 |
|---|---|---|

Mechanical and electrical simple harmonic oscillators, Damped harmonic oscillator, Forced mechanical and electrical oscillators, Impedance, Steady state motion of forced damped harmonic oscillator; Transverse wave on a string, the wave equation on a string, Harmonic waves, Reflection and transmission of waves at a boundary, Longitudinal waves and the wave equation for them, acoustics waves.

**Text Books:**

1. Dr. K Vijay Kumar and Dr. S Chandralingam, "Modern Engineering Physics" Volume-1&2, S Chand.Co, 2018.
2. I. G. Main, "Vibrations and Waves in Physics", Cambridge University Press, 1993.
3. R. K. Gaur, S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Edition, 2001.

**Reference Books:**

1. H.J. Pain, "The Physics of Vibrations and Waves", Wiley, 2006.
2. A. Ghatak, "Optics", McGraw Hill Education, 2012.
3. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

**Web References:**

1. http://link.springer.com/book
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

**E-Text Books:**

1. http://www.peaceone.net/basic/Feynman/
2. http://physicsdatabase.com/free-physics-books/
3. http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf
4. http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html

# PROGRAMMING FOR PROBLEM SOLVING

**I Semester: AE / ME | II Semester: CSE / IT / ECE / EEE / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| ACSB01 | Foundation | 3 | 0 | 0 | 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. Learn adequate knowledge by problem solving techniques.
II. Understand programming skills using the fundamentals and basics of C Language.
III. Improve problem solving skills using arrays, strings, and functions.
IV. Understand the dynamics of memory by pointers.
V. Study files creation process with access permissions.

| MODULE - I | INTRODUCTION | Classes: 10 |
|---|---|---|

Introduction to Programming: Computer system, components of a computer system, computing environments, computer languages, creating and running programs, algorithms, flowcharts; Introduction to C language: Computer languages, History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types; Operators and expressions.

| MODULE - II | CONTROL STRUCTURES | Classes: 08 |
|---|---|---|

Conditional Control structures: Decision statements; Simple if, if-else, else if ladder, Nested if and Case Statement-switch statement; Loop control statements: while, for and do while loops. jump statements, break, continue, goto statements

| MODULE - III | ARRAYS AND FUNCTIONS | Classes: 10 |
|---|---|---|

Arrays: Concepts, one dimensional arrays, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi-dimensional arrays; Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.

Functions: Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directive

| MODULE - IV | STRUCTURES, UNIONS AND POINTERS | Classes: 09 |
|---|---|---|

Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, passing structures through pointers, self-referential structures, unions, bit fields, typedef, enumerations; Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, pointers and arrays, pointers as functions arguments, functions returning pointers. Dynamic memory allocation: Basic concepts, library functions

| MODULE - V | FILE HANDLING AND BASICALGORITHMS | Classes: 08 |
|---|---|---|

Files: Streams, basic file operations, file types, file opening modes, input and output operations with files, special functions for working with files, file positioning functions, command line arguments. Searching, basic sorting algorithms (bubble, insertion, selection), algorithm complexity through example programs (no formal definitions required).

**Text Books:**

1. Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd Edition, 2017.
2. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education, 6th Edition, 2012.

**Reference Books:**

1. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd Edition, 1988.
2. YashavantKanetkar, "Exploring C", BPB Publishers, 2nd Edition, 2003.
3. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
4. R. S. Bichkar, "Programming with C", Universities Press, 2nd Edition, 2012.
5. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2nd Edition, 2006.
6. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

**Web References:**

1. https://www.bfoit.org/itp/Programming.html
2. https://www.khanacademy.org/computing/computer-programming
3. https://www.edx.org/course/programming-basics-iitbombayx-cs101-1x-0
4. https://www.edx.org/course/introduction-computer-science-harvardx-cs50x

**E-Text Books:**

1. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.htm
2. http://www.imada.sdu.dk/~svalle/courses/dm14-2005/mirror/c/
3. http://www.enggnotebook.weebly.com/uploads/2/2/7/1/22718186/ge6151-notes.pdf

**MOOC Course**

1. https://www.alison.com/courses/Introduction-to-Programming-in-c
2. http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c-and-c-january-iap-2014/index.htm

# ENGINEERING PHYSICS LABORATORY

**I Semester: AE / ECE / ME | II Semester: CSE / IT / CE / EEE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB10 | Foundation | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 36 | | | | Total Classes: 36 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Upgrade practical knowledge in optics.
II. Analyze the behavior and characteristics of various materials for its optimum utilization.
III. Enrich the knowledge of electric and magnetic properties.

## LIST OF EXPERIMENTS

| | |
|---|---|
| **Week-l** | **INTRODUCTION TO PHYSICS LABORATORY** |
| Do's and Don'ts in physics laboratory. Precautions to be taken in laboratory. | |
| **Week-2** | **HALL EFFECT ( LORENTZ FORCE )** |
| Determination of charge carrier density. | |
| **Week-3** | **MELDE'E EXPERIMENT** |
| Determination of frequency of a given tuning fork. | |
| **Week-4** | **STEWART GEE'S APPARATUS** |
| Magnetic field along the axis of current carrying coil-Stewart and Gee's method. | |
| **Week-5** | **B-H CURVE WITH CRO** |
| To determine the value of retentivity and coercivity of a given magnetic material. | |
| **Week-6** | **ENERGY GAP OF A SEMICONDUCTOR DIODE** |
| Determination of energy gap of a semiconductor diode. | |
| **Week-7** | **PIN AND AVALANCHE DIODE** |
| Studying V-I characteristics of PIN and Avalanche diode. | |
| **Week-8** | **OPTICAL FIBER** |
| Evaluation of numerical aperture of a given optical fiber. | |
| **Week-9** | **WAVE LENGTH OF LASER LIGHT** |
| Determination of wavelength of a given laser light using diffraction grating. | |

| | |
|---|---|
| **Week-10** | **PLANK'S CONSTANT** |
| Determination of Plank's constant using LED. | |
| **Week-11** | **LIGHT EMITTING DIODE** |
| Studying V-I characteristics of LED | |
| **Week-12** | **NEWTONS RINGS** |
| Determination of radius of curvature of a given plano-convex lens. | |
| **Week-13** | **SINGLE SLIT DIFFRACTION** |
| Determination of width of a given single slit. | |
| **Manuals:** | |
| 1. C. L. Arora, "Practical Physics", S. Chand & Co., New Delhi, 3rd Edition, 2012.<br>2. Vijay Kumar, Dr. T. Radhakrishna, "Practical Physics for Engineering Students", S M Enterprises, 2nd Edition, 2014. | |
| **Web Reference:** | |
| http://www.iare.ac.in | |

# PROGRAMMING FOR PROBLEM SOLVING LABORATORY

**I Semester: AE / ME | II Semester: CSE / IT / ECE / EEE / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| ACSB02 | Foundation | 0 | 0 | 4 | 2 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 36 | | | | Total Classes:36 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Formulate problems and implement algorithms using C programming language.
II. Develop programs using decision structures, loops and functions.
III. Learn memory allocation techniques using pointers.
IV. Use structured programming approach for solving of computing problems in real world.

## LIST OF EXPERIMENTS

### Week-1 OPERATORS AND EVALUATION OF EXPRESSIONS

a. Write a C program to check whether a number is even or odd using ternary operator.
b. Write a C program to perform the addition of two numbers without using +operator.
c. Write a C program to evaluate the arithmetic expression ((a + b / c * d - e) * (f - g)). Read the values a, b, c, d, e, f, g from the standard input device.
d. Write a C program to find the sum of individual digits of a 3 digit number.
e. Write a C program to read the values of x and y and print the results of the following expressions in one line:
   i. (x + y) / (x -y)
   ii. (x + y)(x - y)

### Week-2 CONTROL STRUCTURES

a. Write a C program to find the sum of individual digits of a positive integer.
b. A Fibonacci sequence is defined as follows: The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of these sequences.
c. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
d. A character is entered through keyboard. Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if-else and switch case. The following table shows the range of ASCII values for various characters.

| Characters | ASCII values |
|---|---|
| A–Z | 65 –90 |
| a – z | 97 –122 |
| 0 – 9 | 48 – 57 |
| Special symbols | 0 – 47, 58 – 64, 91 – 96, 123 –127 |

e. If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Write a C program to determine how much profitor loss incurred in percentage.

| Week-3 | CONTROL STRUCTURES |
|---|---|

a. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switch statement).
b. Write a C program to calculate the following sum:

$$sum = 1 - x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$$

c. Write a C program to find the roots of a quadratic equation.
d. Write a C program to check whether a given 3 digit number is Armstrong number or not.
e. Write a C program to print the numbers in triangular form

```
1
1 2
1 2 3
1 2 3 4
```

| Week-4 | ARRAYS |
|---|---|

a. Write a C program to find the second largest integer in a list of integers.
b. Write a C program to perform the following:
   i. Addition of two matrices
   ii. Multiplication of two matrices
c. Write a C program to count and display positive, negative, odd and even numbers in an array.
d. Write a C program to merge two sorted arrays into another array in a sorted order.
e. Write a C program to find the frequency of a particular number in a list of integers.

| Week-5 | STRINGS |
|---|---|

a. Write a C program that uses functions to perform the following operations:
   i. To insert a sub string into a given main string from a given position.
   ii. To delete n characters from a given position in a given string.
b. Write a C program to determine if the given string is a palindrome or not.
c. Write a C program to find a string within a sentence and replace it with another string.
d. Write a C program that reads a line of text and counts all occurrence of a particular word.
e. Write a C program that displays the position or index in the string S where the string T begins, or 1if S doesn‘t contain T.

| Week-6 | FUNCTIONS |
|---|---|

a. Write C programs that use both recursive and non-recursive functions
   i. To find the factorial of a given integer.
   ii. To find the greatest common divisor of two given integers.
b. Write C programs that use both recursive and non-recursive functions
   i. To print Fibonacci series.
   ii. To solve towers of Hanoi problem.
c. Write a C program to print the transpose of a given matrix using function.
d. Write a C program that uses a function to reverse a given string.

| Week-7 | POINTERS |
|---|---|

a. Write a C program to concatenate two strings using pointers.
b. Write a C program to find the length of string using pointers.
c. Write a C program to compare two strings using pointers.
d. Write a C program to copy a string from source to destination using pointers.
e. Write a C program to reverse a string using pointers.

| Week-8 | STRUCTURES AND UNIONS |
|---|---|

a. Write a C program that uses functions to perform the following operations:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition and subtraction of two complex numbers
   iv. Multiplication of two complex numbers. Note: represent complex number using a structure.
b. Write a C program to compute the monthly pay of 100 employees using each employee‘s name, basic pay. The DA is computed as 52% of the basic pay. Gross-salary (basic pay + DA). Print the employees name and gross salary.
c. Create a Book structure containing book_id, title, author name and price. Write a C program to pass a structure as a function argument and print the book details.
d. Create a union containing 6 strings: name, home_address, hostel_address, city, state and zip. Write a C program to display your present address.
e. Write a C program to define a structure named DOB, which contains name, day, month and year. Using the concept of nested structures display your name and date of birth.

| Week-9 | ADDITIONAL PROGRAMS |
|---|---|

a. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$ . For example: if n is 3 and x is 5, then the program computes 1+5+25+125. Print x, n, the sum. Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.
b. 2‘s complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2‘s complement of 11100 is 00100. Write a C program to find the 2‘s complement of a binary number.
c. Write a C program to convert a Roman numeral to its decimal equivalent. E.g. Roman number CD is equivalent to400.

| Week-10 | PREPROCESSOR DIRECTIVES |
|---|---|

a. Define a macro with one parameter to compute the volume of a sphere. Write a C program using this macro to compute the volume for spheres of radius 5, 10 and 15meters.
b. Define a macro that receives an array and the number of elements in the array as arguments. Write a C program for using this macro to print the elements of the array.
c. Write symbolic constants for the binary arithmetic operators +, -, *, and /. Write a C program to illustrate the use of these symbolic constants.

| Week-11 | FILES |
|---|---|

a. Write a C program to display the contents of a file.
b. Write a C program to copy the contents of one file to another.
c. Write a C program to reverse the first n characters in a file, where n is given by the user.
d. Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA i.e., the contents of the first file followed by those of the second are put in the third file.
e. Write a C program to count the no. of characters present in the file.

| Week-12 | COMMAND LINE ARGUMENTS AND NUMERICAL METHODS |
|---|---|

a. Write a C program to read two numbers at the command line and perform arithmetic operations on it.
b. Write a C program to read a file name at the command line and display its contents.
c. Write a C program to solve numerical methods problems (root finding, numerical differentiation and numerical integration)

**Reference Books:**


1. Yashavant Kanetkar, "Let Us C", BPB Publications, New Delhi, 13th Edition, 2012.
2. Oualline Steve, "Practical C Programming", O'Reilly Media, 3rd Edition, 1997.
3. King KN, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition, 2015.
4. Kochan Stephen G, "Programming in C: A Complete Introduction to the C Programming Language", Sam's Publishers, 3rd Edition, 2004.
5. Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India, 1st Edition, 1994.


**Web References:**

1. http://www.sanfoundry.com/c-programming-examples
2. http://www.geeksforgeeks.org/c
3. http://www.cprogramming.com/tutorial/c
4. http://www.cs.princeton.edu

## WORKSHOP / MANUFACTURING PRACTICES LABORATORY

**I Semester: CSE / IT / ECE | II Semester: EEE / AE / ME / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AMEB01 | Foundation | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| Contact Classes: 14 | Tutorial Classes: Nil | Practical Classes: 36 | | | | Total Classes: 50 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Identify and use of tools, types of joints in carpentry, fitting, tin smithy and plumbing operations.
II. Understand of electrical wiring and components.
III. Observation of the function of lathe, shaper, drilling, boring, milling, grinding machines.

### LIST OF EXPERIMENTS

| | |
|---|---|
| **Week-1** | **MACHINE SHOP-Turning and other machines** |

Batch I: Working on central lathe and shaping machine.
Batch II: Working on drilling, grinding machines.

| | |
|---|---|
| **Week-2** | **MACHINE SHOP-Milling and other machines** |

Batch I: Working on milling machine.
Batch II: Working on milling and shaping machine.

| | |
|---|---|
| **Week-3** | **ADVANCED MACHINE SHOP** |

Batch I: Working on CNC Turning machines.
Batch II: Working on CNC Vertical Drill Tap Center.

| | |
|---|---|
| **Week-4** | **FITTING** |

Batch I: Make a straight fit and straight fit for given dimensions.
Batch II: Make a square fit for straight fit for given sizes.

| | |
|---|---|
| **Week-5** | **CARPENTRY-I** |

Batch I: Preparation of lap joint as per given dimensions.
Batch II: Preparation of dove tail joint as per given taper angle.

| | |
|---|---|
| **Week-6** | **CARPENTRY-II** |

Batch I: Preparation of dove tail joint as per given taper angle.
Batch II: Preparation of lap joint as per given dimensions.

| | |
|---|---|
| **Week-7** | **ELECTRICAL AND ELECTRONICS** |

| | |
|---|---|
| Batch I & II: Make an electrical connection to demonstrate domestic voltage and current sharing.<br>Make an electrical connection to control one bulb with two switches-stair case connection. | |
| **Week-8** | **WELDING** |
| Batch I: Arc welding & Gas Welding.<br>Batch II: Gas welding & Arc Welding. | |
| **Week-9** | **MOULD PREPARATION** |
| Batch I: Prepare a wheel flange mould using a given wooden pattern.<br>Batch II: Prepare a bearing housing using an aluminum pattern. | |
| **Week-10** | **MOULD PREPARATION** |
| Batch I: Prepare a bearing housing using an aluminum pattern.<br>Batch II: Prepare a wheel flange mould using a given wooden pattern. | |
| **Week-11** | **BLACKSMITHY- I, TINSMITHY- I,** |
| Batch I: Prepare S-bend & J-bend for given MS rod using open hearth furnace.<br>Batch II: Prepare the development of a surface and make a rectangular tray and a round tin. | |
| **Week-12** | **TINSMITHY- I, BLACKSMITHY- I** |
| Batch I: Prepare the development of a surface and make a rectangular tray and a round tin.<br>Batch II: Prepare S-bend & J-bend of given MS rod using open hearth furnace. | |
| **Week-13** | **PLASTIC MOULDING, INJECTION MOULDING, GLASS CUTTING** |
| Batch I: Plastic Moulding and Glass cutting.<br>Batch II: Plastic Moulding and Glass cutting. | |
| **Week-14** | **BLOW MOULDING** |
| Batch I& II: Blow Moulding. | |

**Reference Books:**


1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S, Steven S. Schmid, "Manufacturing Engineering and Technology", Pearson Education India Edition, 4th Edition, 2002.
3. Gowri P. Hariharan, A. Suresh Babu," Manufacturing Technology – I", Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", Prentice Hall India, 4th Edition, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw-Hill House, 2017.


**Web References:**

http://www.iare.ac.in

## ENGLISH

**I Semester: ECE / EEE /CE | II Semester: AE / CSE / IT / ME**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB01 | Foundation | 2 | 0 | 0 | 2 | 30 | 70 | 100 |
| **Contact Classes:** 45 | **Tutorial Classes:** Nil | **Practical Classes: Nil** | | | | **Total Classes: 45** | | |

**OBJECTIVES:**

The course should enable the students to:

I. Communicate in an intelligible English accent and pronunciation.
II. Use the four language skills i.e., Listening, Speaking, Reading and Writing effectively.
III. Develop the art of writing accurate English with correct spelling, grammar and punctuation.

| | | |
|---|---|---|
| **MODULE - I** | **GENERAL INTRODUCTION AND LISTENIG SKILLS** | **Classes: 07** |

Introduction to communication skills; Communication process; Elements of communication; Soft skills vs hard skills; Importance of soft skills for engineering students; Listening skills; Significance; Stages of listening; Barriers to listening and effectiveness of listening; Listening comprehension.

| | | |
|---|---|---|
| **MODULE - II** | **SPEAKING SKILLS** | **Classes: 09** |

Significance; Essentials; Barriers and effectiveness of speaking; Verbal and non-verbal communication; Generating talks based on visual prompts; Public speaking; Addressing a small group or a large formal gathering; Oral presentation; Power point presentation.

| | | |
|---|---|---|
| **MODULE - III** | **VOCABULARY & GRAMMAR** | **Classes: 10** |

**Vocabulary:**

The concept of Word Formation; Root words from foreign languages and their use in English; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms; Antonyms; Standard abbreviations; Idioms and phrases; One word substitutes.

**Grammar:**

Sentence structure; Uses of phrases and clauses; Punctuation; Subject verb agreement; Modifiers; Articles; Prepositions.

| | | |
|---|---|---|
| **MODULE - IV** | **READING SKILLS** | **Classes: 09** |

Significance; Techniques of reading; Skimming-Reading for the gist of a text; Scanning - Reading for specific information; Intensive; Extensive reading; Reading comprehension;; Reading for information transfer; Text to diagram; Diagram to text.

| | | |
|---|---|---|
| **MODULE - V** | **WRITING SKILLS** | **Classes: 10** |

Significance; Effectiveness of writing; Organizing principles of Paragraphs in documents; Writing introduction and conclusion; Techniques for writing precisely; Letter writing; Formal and Informal letter writing; E-mail writing , Report Writing.

**Text Books:**

Handbook of English for Communication (Prepared by Faculty of English, IARE)

**Reference Books:**

1. Sanjay Kumar and Pushp Lata. “Communications Skills”. Oxford University Press. 2011.
2. Michael Swan. “Practical English Usage”, Oxford University Press, 1995.
3. F.T. Wood. “Remedial English Grammar”, Macmillan. 2007.
4. William Zinsser. “On Writing Well”. Harper Resource Book, 2001.
5. Raymond Murphy, “Essential English Grammar with Answers”, Cambridge University Press, 2nd Edition.

**Web References:**

1. www.edufind.com
2. www.myenglishpages.com
3. http://grammar.ccc.comment.edu
4. http://owl.english.prudue.edu

**E-Text Books:**

1. http://bookboon.com/en/communication-ebooks-zip
2. http://www.bloomsbury-international.com/images/ezone/ebook/writing-skills-pdf.pdf
3. https://americanenglish.state.gov/files/ae/resource_files/developing_writing.pdf
4. http://learningenglishvocabularygrammar.com/files/idiomsandphraseswithmeaningsandexamplespdf.pdf
5. http://www.robinwood.com/Democracy/General Essays/CriticalThinking.pdf

# MATHEMATICAL TRANSFORM TECHNIQUES

**II Semester:** **AE / ECE / EEE / ME / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB11 | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Enrich the knowledge of solving algebra and transcendental equations and differential equation by numerical methods.
II. Determine the Fourier coefficients for various functions in a given period.
III. Formulate to solve partial differential equation.

| | | |
|---|---|---|
| **MODULE - I** | **ROOT FINDING TECHNIQUES AND INTERPOLATION** | **Classes: 09** |

Root finding techniques: Solving algebraic and transcendental equations by bisection method, method of false position, Newton-Raphson method; Interpolation: Finite differences, forward differences, backward differences and central differences; Symbolic relations; Newton's forward interpolation, Newton's backward interpolation; Gauss forward central difference formula, Gauss backward central difference formula; Interpolation of unequal intervals: Lagrange's interpolation.

| | | |
|---|---|---|
| **MODULE -II** | **CURVE FITTING AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS** | **Classes: 09** |

Fitting a straight line; Second degree curves; Exponential curve, power curve by method of least squares; Taylor's series method; Step by step methods: Euler's method, modified Euler's method and Runge-Kutta method for first order differential equations.

| | | |
|---|---|---|
| **MODULE - III** | **LAPLACE TRANSFORMS** | **Classes: 09** |

Definition of Laplace transform, linearity property, piecewise continuous function, existence of Laplace transform, function of exponential order, first and second shifting theorems, change of scale property, Laplace transforms of derivatives and integrals, multiplied by t, divided by t, Laplace transform of periodic functions.

Inverse Laplace transform: Definition of Inverse Laplace transform, linearity property, first and second shifting theorems, change of scale property, multiplied by s, divided by s; Convolution theorem and applications.

| | | |
|---|---|---|
| **MODULE - IV** | **FOURIER TRANSFORMS** | **Classes: 09** |

Fourier integral theorem, Fourier sine and cosine integrals; Fourier transforms; Fourier sine and cosine transform, properties, inverse transforms, finite Fourier transforms.

| | | |
|---|---|---|
| **MODULE - V** | **PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS** | **Classes: 09** |

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equation by Lagrange method; Charpit's method; method of separation of variables; One dimensional heat and wave equations under initial and boundary conditions.

**Text Books:**

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36th Edition, 2010.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2010.

**Reference Books:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition, 2006.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", Brooks/Cole, 2nd Edition, 2005.
4. Dr. M Anita, Engineering Mathematics-I, Everest Publishing House, Pune, 1st Edition, 2016.

**Web References:**

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://www.mathworld.wolfram.com/

**E-Text Books:**

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

# ENGINEERING CHEMISTRY

**I Semester:** CSE / IT/ EEE | **II Semester:** AE / ECE / ME / CE

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB03 | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Apply the electrochemical principles in batteries, understand the fundamentals of corrosion.
II. Analysis of water for its various parameters and its significance in industrial and domestic Applications.
III. Analyze microscopic chemistry in terms of atomic, molecular orbitals and Intermolecular forces
IV. Analysis of major chemical reactions that are used in the synthesis of molecules.
V. Understand the chemistry of various fuels and their combustion.

| MODULE-I | ELECTROCHEMISTRY AND CORROSION | Classes: 09 |
|---|---|---|

Electro chemical cells: Electrode potential, standard electrode potential, types of electrodes; Calomel, Quinhydrone and glass electrode; Nernst equation; Electrochemical series and its applications; Numerical problems; Batteries: Primary (Dry cell) and secondary batteries (Lead-acid storage battery and Lithium ion battery).

Causes and effects of corrosion: Theories of chemical and electrochemical corrosion, mechanism of electrochemical corrosion; Types of corrosion: Galvanic, water-line and pitting corrosion; Factors affecting rate of corrosion; Corrosion control methods: Cathodic protection, sacrificial anode and impressed current; Surface coatings: Metallic coatings- Methods of coating- Hot dipping, cementation, electroplating and Electroless plating of copper.

| MODULE -II | WATER AND ITS TREATMENT | Classes: 08 |
|---|---|---|

Introduction: Hardness of water, Causes of hardness; Types of hardness: temporary and permanent, expression and units of hardness; Estimation of hardness of water by complexometric method; Potable water and its specifications, Steps involved in treatment of water, Disinfection of water by chlorination and ozonization; Boiler feed water and its treatment, Calgon conditioning, Phosphate conditioning and Colloidal conditioning; External treatment of water; Ion-exchange process; Desalination of water: Reverse osmosis, numerical problems.

| MODULE-III | MOLECULAR STRUCTURE AND THEORIES OF BONDING | Classes: 08 |
|---|---|---|

Shapes of Atomic orbitals, Linear Combination of Atomic orbitals (LCAO), molecular orbitals of diatomic molecules; Molecular orbital energy level diagrams of $N_2$, $O_2$,$F_2$ ,CO and NO molecules.

Crystal Field Theory (CFT): Salient Features of CFT-Crystal Fields; Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries; Band structure of solids and effect of doping on conductance.

| MODULE -IV | STEREOCHEMISTRY, REACTION MECHANISM AND SYNTHESIS OF DRUG MOLECULES | Classes: 12 |
|---|---|---|
| Introduction to representation of 3-dimensional structures: Structural and stereoisomers, configurations, symmetry and chirality; Enantiomers, diastereomers, optical activity and Absolute configuration; Confirmation analysis of n- butane. Substitution reactions: Nucleophilic substitution reactions, Mechanism of $SN^1$, $SN^2$ reactions; Electrophilic and nucleophilic addition reactions; Addition of HBr to propene; Markownikoff and anti Markownikoff's additions; Grignard additions on carbonyl compounds; Elimination reactions: Dehydro halogenation of alkylhalides; Saytzeff rule; Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and chromicacid; Reduction reactions: Reduction of carbonyl compounds using $LiAlH_4$ & $NaBH_4$; Hydroboration of olefins; Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin. | | |
| **MODULE –V** | **FUELS AND COMBUSTION** | **Classes: 08** |
| Fuels: Definition, classification of fuels and characteristics of a good fuels; Solid fuels: Coal; Analysis of coal: Proximate and ultimate analysis; Liquid fuels: Petroleum and its refining; Cracking: Fixed bed catalytic cracking; Knocking: Octane and cetane numbers; Gaseous fuels: Composition, characteristics and applications of natural gas, LPG and CNG; Combustion: Calorific value: Gross Calorific Value(GCV) and Net Calorific Value(NCV), calculation of air quantity required for complete combustion of fuel, numerical problems. | | |

**Text Books:**


1. P. C. Jain, Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, 2017.
2. Shasi Chawla, "Text Book of Engineering Chemistry", Dhantpat Rai Publishing Company, New Delhi, 2017.
2. R.T. Morrison, RN Boyd and SK Bhattacharya "Organic Chemistry", Pearson, 7th Edition, 2011.
3. K.F. Purcell and J.C. Kotz, "Inorganic Chemistry", Cengage learning, 2017.


**Reference Books:**


1. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry Structure and Functions", Oxford Publications, 7th Edition.
2. B. H. Mahan, "University Chemistry", Narosa Publishers, 4th Edition, 2009.


**Web References:**

1. Engineering Chemistry (NPTEL Web-book), by B.L.Tembe, Kamaluddin and M.S.Krishnan.

# ENGINEERING MECHANICS

**II Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AMEB03 | Foundation | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand the aircraft structural components and its behavior under different loading conditions.
II. Obtain knowledge in plate buckling and structural instability of stiffened panels for airframe structural analysis.
III. Explain the thin walled section and structural idealization of panels and differentiate from the type of loads carried.
IV. Solve for stresses and deflection in aircraft structures like fuselage, wing and landing gear.

| MODULE-I | INTRODUCTION TO ENGINEERING MECHANICS | Classes: 10 |
|---|---|---|

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

| MODULE -II | FRICTION AND BASICS STRUCTURAL ANALYSIS | Classes: 09 |
|---|---|---|

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

| MODULE -III | CENTROID AND CENTRE OF GRAVITY AND VIRTUAL WORK AND ENERGY METHOD | Classes: 10 |
|---|---|---|

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

| MODULE -IV | PARTICLE DYNAMICS AND INTRODUCTION TO KINETICS | Classes: 08 |
|---|---|---|

Particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in

| | | |
|---|---|---|
| dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation; | | |
| **MODULE -V** | **MECHANICAL VIBRATIONS** | **Classes: 08** |
| Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums; | | |

**Text Books:**

1. Irving H. Shames (2006), "Engineering Mechanics", Prentice Hall, 4th Edition, 2013
2. F. P. Beer and E. R. Johnston (2011), "Vector Mechanics for Engineers", Vol I - Statics, Vol II, – Dynamics, Tata McGraw Hill , 9th Edition, 2013.
3. R. C. Hibbler (2006), "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press.

**Reference Books:**

1. S.Bhavikatti, "A Text Book of Engineering Mechanics", New Age International, 1st Edition, 2012.
2. A.K.Tayal, "Engineering Mechanics", Uma Publications, 14th Edition, 2013.
3. R. K. Bansal "Engineering Mechanics", Laxmi Publication, 8th Edition, 2013.
4. Basudeb Bhattacharya, "Engineering Mechanics", Oxford University Press, 2nd Edition, 2014.
5. K.Vijay Reddy, J. Suresh Kumar, "Singer's Engineering Mechanics Statics and Dynamics", B S Publishers, 1st Edition, 2013.

**Web References:**

1. https://en.wikipedia.org/wiki/Dynamics_(mechanics)
2. https://www.youtube.com/playlist?list=PLUl4u3cNGP62esZEwffjMAsEMW_YArxYC

**E-Text Books:**

1. http://www.freeengineeringbooks.com/Civil/Engineering-Mechanics-Books.php
2. http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-ema-em-2.pdf
3. http://www.faadooengineers.com/threads/17024-Engineering-mechanics-pdf-Free-Download

## ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

**I Semester: ECE / EEE /CE | II Semester: AE / CSE / IT / ME**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB08 | Foundation | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 24 | | | | Total Classes: 24 | | |

**OBJECTIVES:**

**The course enables the students to:**

I. Improve their ability to listen and comprehend a given text.
II. Upgrade the fluency and acquire a functional knowledge of English Language.
III. Enrich thought process by viewing a problem through multiple angles.

### LIST OF ACTIVITIES

| | |
|---|---|
| **Week-l** | **LISTENING SKILL** |

a. Listening to conversations and interviews of famous personalities in various fields; Listening practice related to the TV talk shows and news.
b. Listening for specific information; Listening for summarizing information – Testing.

| | |
|---|---|
| **Week-2** | **LISTENING SKILL** |

a. Listening to films of short duration and monologues for taking notes; Listening to answer multiple choice questions.
b. Listening to telephonic conversations; Listening to native Indian: Abdul Kalam, British: Helen Keller and American: Barrack Obama speakers to analyze intercultural differences – Testing.

| | |
|---|---|
| **Week-3** | **SPEAKING SKILL** |

a. Functions of English Language; Introduction to pronunciation; Vowels and Consonants
b. Tips on how to develop fluency, body language and communication; Introducing oneself: Talking about yourself, others, leave taking.

| | |
|---|---|
| **Week-4** | **SPEAKING SKILL** |

a. Sounds - Speaking exercises involving the use of Vowels and Consonant sounds in different contexts; Exercises on Homophones and Homographs
b. Just a minute (JAM) session.

| | |
|---|---|
| **Week-5** | **SPEAKING SKILL** |

a. Stress patterns.
b. Situational Conversations: common everyday situations; Acting as a compere and newsreader; Greetings for different occasions with feedback preferably through video recording.

| | |
|---|---|
| **Week-6** | **READING SKILL** |
| a. Intonation.<br>b. Reading newspaper and magazine articles; Reading selective autobiographies for critical commentary. | |
| **Week-7** | **READING SKILL** |
| a. Improving pronunciation through tongue twisters.<br>b. Reading advertisements, pamphlets; Reading comprehension exercises with critical and analytical questions based on context. | |
| **Week-8** | **WRITING SKILL** |
| a. Listening to inspirational short stories.<br>b. Writing messages, leaflets, Notice; Writing tasks; Flashcards – Exercises. | |
| **Week-9** | **WRITING SKILL** |
| a. Write the review on a video clipping of short duration (5 to 10minutes).<br>b. Write a slogan related to the image; Write a short story of 6-10 lines based on the hints given. | |
| **Week-10** | **WRITING SKILL** |
| a. Minimizing Mother Tongue Influence to improve fluency through watching educational videos.<br>b. Writing practices – précis writing; Essay writing. | |
| **Week-11** | **THINKING SKILL** |
| a. Correcting common errors in day to day conversations.<br>b. Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms, proverbs. | |
| **Week-12** | **THINKING SKILL** |
| a. Correcting common errors in day to day conversations.<br>b. Making pictures and improvising diagrams to form English words, phrases and proverbs. | |
| **Reference Books:** | |
| 1. Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles and Practices", Oxford University Press, New Delhi, 3rd Edition, 2015.<br>2. Rhirdion, Daniel, "Technical Communication", Cengage Learning, New Delhi, 1st Edition, 2009. | |
| **Web References:** | |
| 1. http://learnenglish.britishcouncil.org<br>2. http://www.esl-lab.com/<br>3. http://www.elllo.org/ | |

## EQUIPMENT REQUIRED FOR A BATCH OF 60 STUDENTS (ORAL AND MULTIMEDIA)

1. Career laboratory: 1 Room
2. Server computer for the laboratory with high configuration: 1 no
3. Computers: 30 nos
4. Software: K Van Solution
5. LCD Projector: 1 no
6. Speakers with amplifiers, one wireless mic and one collar mic
7. Podium: 1
8. Chairs: 30
9. Discussion Tables: 2
10. White board: 1

## ENGINEERING CHEMISTRY LABORATORY

| **I Semester: CSE / IT / EEE \| II Semester: AE / ECE / ME / CE** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| **AHSB09** | **Foundation** | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| **Contact Classes: Nil** | **Tutorial Classes: Nil** | **Practical Classes: 36** | | | | **Total Classes: 36** | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Analyze, interpret, and draw conclusions from experimental data.
II. Describe the fluid property of surface tension and viscosity.
III. Perform a complexometric titration to determine the hardness of water from various sources.
IV. Comprehend the experimental results.

### LIST OF EXPERIMENTS

| | |
|---|---|
| **Week-l** | **INTRODUCTION TO CHEMISTRY LABORATORY** |
| Introduction to chemistry laboratory. Do's and Don'ts in chemistry laboratory. | |
| **Week-2** | **PREPARATION OF ORGANIC COMPOUNDS** |
| Synthesis of Aspirin. | |
| **Week-3** | **VOLUMETRIC ANALYSIS** |
| Estimation of Total hardness of water by complexometric method using EDTA. | |
| **Week-5** | **INSTRUMENTATION** |
| Estimation of an HCl by conductometric titrations. | |
| **Week-6** | **INSTRUMENTATION** |
| Estimation of HCl by potentiometric titrations. | |
| **Week-7** | **INSTRUMENTATION** |
| Estimation of Acetic acid by Conductometric titrations. | |
| **Week-8** | **INSTRUMENTATION** |

| | |
|---|---|
| Estimation of $Fe^{2+}$ by Potentiometry using $KMnO_4$titrations. | |
| **Week-9** | **VOLUMETRIC ANALYSIS** |
| Determination of chloride content of water by Argentometry. | |
| **Week-10** | **PHYSICAL PROPERTIES** |
| Determination of surface tension of a given liquid using Stalagmometer. | |
| **Week-11** | **PHYSICAL PROPERTIES** |
| Determination of viscosity of a given liquid using Ostwald's viscometer. | |
| **Week-12** | **PHYSICAL PROPERTIES** |
| Verification of freundlich adsorption isotherm-adsorption of acetic and on charcoal. | |
| **Week-13** | **ANALYSIS OF ORGANIC COMPOUNDS** |
| Thin layer chromatography calculation of $R_f$ values .Eg: ortho and para nitro phenols. | |
| **Week-14** | **REVISION** |
| Revision. | |

**Reference Books:**


1. Vogel's, "Quantitative Chemical Analysis", Prentice Hall, 6th Edition, 2000.
2. Gary D. Christian, "Analytical Chemistry", Wiley India, 6th Edition, 2007.


**Web References:**

http://www.iare.ac.in

**LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:**

| S. No | Name of the Apparatus | Apparatus Required | Quantity |
|---|---|---|---|
| 1 | Analytical balance | 04 | 100 gm |
| 2 | Beaker | 30 | 100 ml |
| 3 | Burette | 30 | 50 ml |
| 4 | Burette Stand | 30 | Metal |
| 5 | Clamps with Boss heads | 30 | Metal |
| 6 | Conical Flask | 30 | 250 ml |
| 7 | Conductivity cell | 10 | K=1 |
| 8 | Calomel electrode | 10 | Glass |

| | | | |
|---|---|---|---|
| 9 | Digital Potentiometer | 10 | EI |
| 10 | Digital Conductivity meter | 10 | EI |
| 11 | Digital electronic balance | 01 | RI |
| 12 | Distilled water bottle | 30 | 500 ml |
| 13 | Funnel | 30 | Small |
| 14 | Glass rods | 30 | 20 cm length |
| 15 | Measuring Cylinders | 10 | 10 ml |
| 16 | Oswald Viscometer | 30 | Glass |
| 17 | Pipette | 30 | 20 ml |
| 18 | Platinum Electrode | 10 | PP |
| 19 | Porcelain Tiles | 30 | White |
| 20 | Reagent bottle | 30 | 250 ml |
| 21 | Standard Flask | 30 | 100 ml |
| 22 | Stalagmo meter | 30 | Glass |
| 23 | TLC Plates | 40 | -- |
| 24 | UV Chamber | 02 | -- |

## ENGINEERING GRAPHICS AND DESIGN LABORATORY

**I Semester: ECE / EEE / CE | II Semester: AE / ME / CSE / IT**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AMEB02 | Foundation | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 60 | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to**

I. Understand the basic principles of engineering drawing and construction of curves used in engineering field.
II. Apply the knowledge of interpretation of projection in different quadrants.
III. Understand the projections of solids, when it is inclined to both planes simultaneously.
IV. Convert the pictorial views into orthographic view and vice versa.
V. Create intricate details of components through sections and develop its surfaces.

### LIST OF EXPERIMENTS

**MODULE - I** **INTRODUCTION TO ENGINEERING DRAWING**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales-Plain, Diagonal and Vernier Scales.

**MODULE - II** **OVERVIEW OF COMPUTER GRAPHICS, CUSTOMIZATION & CAD DRAWING, ANNOTATIONS, LAYERING & OTHER FUNCTIONS, DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT**

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids].

Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.

| MODULE - III | ORTHOGRAPHIC PROJECTIONS |
|---|---|

Principles of Orthographic Projections-Conventions-Projections of Points and lines inclined to both planes.

Projections of planes inclined Planes-Auxiliary Planes.

| MODULE - IV | PROJECTIONS OF REGULAR SOLIDS AND SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS |
|---|---|

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale.Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
Draw the sectional orthographic views of geometrical solids ofPrism, Pyramid, Cylinder and Cone; Objects from industry and dwellings (foundation to slab only).

| MODULE - V | DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTIONS |
|---|---|

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone;
Principles of Isometric projection–Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.
DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT:
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

**Text Books**


1. N. D. Bhatt (2012), "Engineering Drawing", Charotar Publications, New Delhi, 49th Edition, 2010.
2. C.M. Agarwal, Basant Agarwal, "Engineering Drawing", Tata McGrawHill, 2nd Edition, 2013.


**Reference Books:**


1. K. Venugopal, "Engineering Drawing and Graphics". New Age Publications, 2nd Edition, 2010.
2. Dhananjay. A. Johle, "Engineering Drawing", Tata McGraw Hill, 1st Edition, 2008.
3. S.Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. International Publishers, 3rd Edition, 2011.
4. A. K. Sarkar, A.P Rastogi, "Engineering graphics with Auto CAD", PHI Learning, 1st Edition, 2010.


**Web References:**

1. http://nptel.ac.in/courses/112103019
2. http://www.autocadtutorials.net/
3. http://gradcab.com/questions/tutorial-16-for -beginner-engineering-drawing-I

**SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:**

**SOFTWARE:** AUTOCAD 2016
**HARDWARE:** 30 numbers of Intel Desktop Computers with 2 GB RAM

# BASIC SIMULATION WITH MAT LABORATORY

**II Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIE | SEE | Total |
| AAEB01 | Foundation | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 24 | | | | Total Classes: 24 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand the procedures, algorithms, and concepts require to solve specific problems
II. Analyze the concepts of algebra, calculus and numerical solutions using MATLAB software.
III. Enrich the knowledge in MATLAB and can apply for project works.
IV. Interpret and visualize simple mathematical functions and operations thereon using plots/display.

## LIST OF EXPERIMENTS

| | |
|---|---|
| **Week-l** | **BASIC FEATURES** |

a. Features and uses.
b. Local environment setup.

| | |
|---|---|
| **Week-2** | **ALGEBRA** |

a. Solving basic algebraic equations.
b. Solving system of equations.
c. Two dimensional plots.

| | |
|---|---|
| **Week-3** | **CONTROL STRUCTURES** |

a. For Loop.
b. While Loop.
c. If- elseif- else control structure.

| | |
|---|---|
| **Week-4** | **MATRICES** |

a. Addition, subtraction and multiplication of matrices.
b. Transpose of a matrix.
c. Inverse of a matrix.

| | |
|---|---|
| **Week-5** | **SYSTEM OF LINEAR EQUATIONS** |

a. Rank of a matrix.
b. Gauss Jordan method.
c. LU decomposition method.

| | |
|---|---|
| **Week-6** | **LINEAR TRANSFORMATION** |

a. Characteristic equation.
b. Eigen values.
c. Eigen vectors.

| Week-7 | DIFFERENTIATION AND INTEGRATION |
|---|---|
| a. Higher order differential equations.<br>b. Double integrals.<br>c. Triple integrals. | |
| **Week-8** | **NUMERICAL DIFFERENTION AND INTEGRATION** |
| a. Trapezoidal, Simpson's method.<br>b. Euler method.<br>c. Runge Kutta method | |
| **Week-9** | **3D PLOTTING** |
| a. Line plotting.<br>b. Surface plotting.<br>a. Volume plotting. | |
| **Week-10** | **DEFLECTION OF SIMPLY SUPPORTED BEAM** |
| a. Calculating vertical displacement with point load.<br>b. Calculating vertical displacement with uniformly distributed load.<br>c. Calculating vertical displacement with uniformly varying load. | |
| **Week-11** | **DEFLECTION OF CANTILEVER BEAM** |
| b. Calculating vertical displacement with point load.<br>c. Calculating vertical displacement with uniformly distributed load.<br>c. Calculating vertical displacement with uniformly varying load | |
| **Week-12** | **FORMULATION OF IDEAL AND REAL GAS EQUATIONS** |
| a. Calculating the pressure, temperature, density for Earth's atmospheric conditions at different altitudes.<br>b. Calculating the pressure, temperature, density for other planets at different altitudes. | |

**Reference Books:**


1. Cleve Moler, "Numerical Computing with MATLAB", SIAM, Philadelphia, 2nd Edition, 2008.
2. Dean G. Duffy, "Advanced Engineering Mathematics with MATLAB", CRC Press, Taylor & Francis Group, 6th Edition, 2015.
3. Delores M. Etter, David C. Kuncicky, Holly Moore, "Introduction to MATLAB 7", Pearson Education Inc, 1st Edition, 2009.
4. Rao. V. Dukkipati , "MATLAB for ME Engineers", New Age Science, 1st Edition, 2008.


**Web Reference:**

http://www.tutorialspoint.com/matlab/
http://www.iare.ac.in

**SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:**

**SOFTWARE:** Microsoft Windows 7 and MATLAB – V 8.5, which is also R2015a

**HARDWARE:** 30 numbers of Intel Desktop Computers with 2 GB RAM

# ENGINEERING THERMODYNAMICS

**III Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB02 | 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 laws of thermodynamics and determine thermodynamic properties and gas laws.
II. Apply Knowledge of properties of pure substances, mixtures, usage of steam tables and Mollier chart, psychometric charts.
III. Understand the direction law and concept of increase of entropy of the universe.
IV. Understand the working of ideal air standard, vapor cycles and evaluate their performance in open systems like steam power plants, internal combustion engines, gas turbines and refrigeration systems.

| MODULE-I | BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS | Classes : 09 |
|---|---|---|

Basic concepts*:* System, control volume, surrounding, boundaries, universe, types of systems, macroscopic and microscopic viewpoints, concept of continuum, thermodynamic equilibrium, state, property, process, cycle, reversibility, quasi static process, irreversible process, causes of irreversibility, various flow and non-flow processes, energy in state and in transition, types-work and heat, point and path function, Zeroth law of thermodynamics, concept of quality of temperature, Principles of thermometry, reference points, constant volume gas thermometer, ideal gas scale, PMMI Joule's experiments, first law of thermodynamics, corollaries first law applied to a process, applied to a flow system, steady flow energy equation.

| MODULE -II | SECOND LAW OF THERMODYNAMICS | Classes : 09 |
|---|---|---|

Limitations of the first law: thermal reservoir, heat engine, heat pump, parameters of performance, second Law of thermodynamics, Kelvin Planck and Clausius statements and their equivalence, Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialties, thermodynamic scale of temperature, Clausius inequality, Entropy, principle of Entropy increase, availability and irreversibility, thermodynamic potentials, Gibbs and Helmholtz functions, Maxwell relations, Third Law of thermodynamics.

| MODULE- III | PURE SUBSTANCES AND MIXTURES OF PERFECT GASES | Classes: 09 |
|---|---|---|

Pure substances: Phase transformations, T-S and H-S diagrams, P-V-T surfaces, triple point at critical state properties during change of phase, dryness fraction, Mollier charts, psychometric properties, dry bulb temperature, wet bulb temperature, dew point temperature, thermodynamic wet bulb temperature, specific humidity, relative humidity, saturated air, vapour pressure, degree of saturation, adiabatic saturation, Carrier's equation, Psychometric chart.

| MODULE-IV | POWER CYCLES | Classes: 09 |
|---|---|---|
| Power cycles: Otto, Diesel, Dual combustion cycles, description and representation on P-V and T-S diagram, thermal efficiency, mean effective pressures on air standard basis, comparison of cycles, introduction to Brayton cycle and Bell Coleman cycle. | | |
| **MODULE- V** | **ELEMENTS OF HEAT TRANSFER AND GAS COMPRESSORS** | **Classes : 09** |
| Basic concepts of Heat Transfer: Conduction, Convection and Radiation, Heat Exchangers, Types of Heat Exchangers. Basic concepts of: Gas Compressors, Air Compressors, Single-Stage Reciprocating Air Compressor, Multi-Stage Compression, Volumetric Efficiency, Air Motors, Rotary Compressors. | | |

**Text Books:**

1. P. K. Nag, "Engineering Thermodynamics", Tata McGraw-Hill, 4th Edition, 2008.
2. Yunus Cengel, Michael A. Boles, "Thermodynamics-An Engineering Approach", Tata McGraw-Hill, 7th Edition, 2011.

**Reference Books:**

1. J. B. Jones, R. E. Dugan, "Engineering Thermodynamics", Prentice Hall of India Learning, 1st Edition, 2009.
2. Y. V. C. Rao, "An Introduction to Thermodynamics", Universities Press, 3rd Edition, 2013.
3. K. Ramakrishna, "Engineering Thermodynamics", Anuradha Publishers, 2nd Edition, 2011.
4. Holman. J.P, "Thermodynamics", Tata McGraw-Hill, 4th Edition, 2013.

**Web References:**

1. https://en.wikipedia.org/wiki/Thermodynamics
2. https://en.wikipedia.org/wiki/Laws_of_thermodynamics
3. http://www.livescience.com/50776-thermodynamics.html
4. https://www3.nd.edu/~powers/ame.20231/planckdover.pdf

**E-Text Book:**

1. https://www3.nd.edu/~powers/ame.20231/planckdover.pdf
2. http://www.ebookdownloadz.net/2014/08/engineering-thermodynamics-by-pknag.html

**Course Home Page:**

## BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

**III Semester: AE / ME / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AEEB04 | Core | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | Total Classes: 60 | | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand Kirchhoff laws and their application in series and parallel electric circuits.
II. Discuss principle and operation of measuring instruments.
III. Analyze the characteristics of alternating quantities, DC machines and AC machines.
IV. Illustrate the V-I characteristics of various diodes and bi-polar junction transistor.

| MODULE - I | ELECTRIC CIRCUITS, ELECTROMAGNETISM AND INSTRUMENTS | Classes: 09 |
|---|---|---|

Electrical Circuits: Basic definitions, types of elements, Ohm's Law, resistive networks, inductive networks, capacitive networks, Kirchhoff's Laws, Series, parallel circuits and star delta transformations, simple problems, Faradays law of electromagnetic induction; Instruments: Basic principles of indicating instruments, permanent magnet moving coil and moving iron instruments.

| MODULE - II | DC MACHINES | Classes: 08 |
|---|---|---|

Principle of operation DC Generator, EMF equation, types, DC motor types, torque equation applications, three point starter.

| MODULE-III | ALTERNATING QUANTITIES AND AC MACHINES | Classes: 10 |
|---|---|---|

Alternating quantities: sinusoidal AC voltage, average, RMS, form and peak factor, concept of three phase alternating quantity; Transformer: Principle of operation, EMF equation, losses, efficiency and regulation.

Three phase induction motor: Principle of operation, slip, slip - torque characteristics, efficiency and applications; Alternator: Principle of operation, EMF Equation, efficiency, and regulation by synchronous impedance method.

| MODULE -IV | SEMICONDUCTOR DIODE AND APPLICATIONS | Classes: 09 |
|---|---|---|

Semiconductor diode: P-N Junction diode, symbol, V-I characteristics, half wave rectifier, full wave rectifier, bridge rectifier and filters, diode as a switch, Zener diode as a voltage regulator.

| MODULE - V | BIPOLAR JUNCTION TRANSISTOR AND APPLICATIONS | Classes: 09 |
|---|---|---|

Bipolar junction: DC characteristics, CE, CB, CC configurations, biasing, load line, Transistor as an amplifier.

**Text Books:**

1. A Chakrabarti, “Circuit Theory”, Dhanpat Rai Publications, 6th Edition, 2004.
2. K S Suresh Kumar, “Electric Circuit Analysis”, Pearson Education, 1st Edition, 2013.
3. Willianm Hayt, Jack E Kemmerly S.M.Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill, 7th Edition, 2010.
4. J P J Millman, C C Halkias, Satyabrata Jit, “Millman‟s Electronic Devices and Circuits”, Tata McGraw Hill, 2nd Edition, 1998.
5. R L Boylestad, Louis Nashelsky, “Electronic Devices and Circuits”, PEI/PHI, 9th Edition, 2006.
6. V K Mehta, Rohit Mehta, “Principles of electrical engineering”, S CHAND, 1st Edition, 2003.

**Reference Books:**

1. David A Bell, “Electric Circuits”, Oxford University Press, 9th Edition, 2016.
2. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9th Edition, 2016.
3. A Bruce Carlson, “Circuits”, Cengage Learning, 1st Edition, 2008.
4. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9th Edition, 2016.
5. A Bruce Carlson, “Circuits”, Cengage Learning, 1st Edition, 2008

**Web References:**

1. https://www.kuet.ac.bd/webportal/ppmv2/uploads/1364120248DC%20Machines2.pdftextofvideo.nptel.iitm.ac.in
2. https://www.eleccompengineering.files.wordpress.com/2014/08/a-textbook-of-electrical-technology-volume-ii-ac-and-dc-machines-b-l-thferaja.pdf
3. https://www.geosci.uchicago.edu/~moyer/GEOS24705/Readings/Klempner_Ch1.pdf
4. https://www.ibiblio.org/kuphaldt/electricCircuits/DC/DC.pdf
5. https://www.users.ece.cmu.edu/~dwg/personal/sample.pdf.
6. https://www.djm.cc/library/Principles_of_Alternating_Current_Machinery_Lawrence_edited.pdf

**E-Text Books:**

1. https://www.kisi.deu.edu.tr/aytac.goren/ELK2015/w10.pdfwww.bookboon.com.
2. https://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/lecture-notes/19_bjt_1.pdf.
3. https://www.google.co.in/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=half+and+full+wave+rectifier+pdf.
4. https://www.leka.lt/sites/default/files/vaizdai/concepts-in-electric-circuits.pdf.
5. https://www.ktustudents.in

**Course Home Page:**

# PROBABILITY AND STATISTICS

**III Semester: AE / ME / CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB12 | Foundation | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Enrich the knowledge of probability on single random variables and probability distributions.
II. Apply the concept of correlation and regression to find covariance.
III. Analyze the given data for appropriate test of hypothesis.

| MODULE-I | PROBABILITY AND RANDOM VARIABLES | Classes: 09 |
|---|---|---|

Probability, Conditional Probability, Baye's Theorem; Random variables: Basic definitions, discrete and continuous random variables; Probability distribution: Probability mass function and probability density functions; Mathematical expectation.

| MODULE -II | PROBABILITY DISTRIBUTION | Classes: 09 |
|---|---|---|

Binomial distribution; Mean and variances of Binomial distribution, Recurrence formula for the Binomial distribution; Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, mean and variance of Poisson distribution, Recurrence formula for the Poisson distribution; Normal distribution; Mean, Variance, Mode, Median, Characteristics of normal distribution.

| MODULE -III | CORRELATIONS AND REGRESSION | Classes: 09 |
|---|---|---|

Correlation: Karle Pearson's Coefficient of correlation, Computation of correlation coefficient, Rank correlation, Repeated Ranks; Properties of correlation.

Regression: Lines of regression, Regression coefficient, Properties of Regression coefficient, Angle between two lines of regression; Multiple correlation and Regression.

| MODULE -IV | TEST OF HYPOTHESIS - I | Classes: 09 |
|---|---|---|

Sampling: Definitions of population, Sampling, Parameter of statistics, standard error; Test of significance: Null hypothesis, alternate hypothesis, type I and type II errors, critical region, confidence interval, level of significance. One sided test, two sided test. Large sample test: Test of significance for single mean, Test of significance for difference between two sample means, Tests of significance single proportion and Test of difference between proportions.

| MODULE -V | TEST OF HYPOTHESIS - II | Classes: 09 |
|---|---|---|

Small sample tests: Student t-distribution, its properties: Test of significance difference between sample mean and population mean; difference between means of two small samples. Snedecor's F-distribution and its properties; Test of equality of two population variances Chi-square distribution and it's properties; Test of equality of two population variances Chi-square distribution, it's properties, Chi-square test of goodness of fit.

**Text Books:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.

**Reference Books:**

1. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand & Co., 10th Edition, 2000.
2. N. P. Bali, "Engineering Mathematics", Laxmi Publications, 9th Edition, 2016.
3. Richard Arnold Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Prentice Hall, 8th Edition, 2013.

**Web References:**

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resourcs/#Mathematics
3. http://www.sosmath.com
4. http://www.mathworld.wolfram.com

**E-Text Books:**

1. http://www.keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook-download.html
2. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks

# FLUID DYNAMICS

**III Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB03 | Core | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Illustrate about the basic properties of a fluid, hydrostatic forces on submerged bodies and different manometers.
II. Derive the basic principles of a fluid-continuity, momentum, Euler and Bernoulli's equations.
III. Explain the concept of boundary layer theory and importance of Prandtl's boundary layer theory.
IV. Understand the flow through pipes and their losses for different geometries.

| MODULE -I | FLUID PROPERTIES AND FLUID STATICS | Classes: 10 |
|---|---|---|

Density, specific weight, specific gravity, surface tension and capillarity, Newton's law of viscosity, incompressible and compressible fluid, numerical problems; Hydrostatic forces on submerged bodies - Pressure at a point, Pascal's law, pressure variation with temperature and height, center of pressure plane, vertical and inclined surfaces; Manometers - simple and differential Manometers, inverted manometers, micro manometers, pressure gauges and numerical problems. Buoyancy - Archimedes principle, metacenter, Meta centric height calculations; Stability.

| MODULE -II | FLUID KINEMATICS AND BASIC EQUATIONS OF FLUID FLOW ANALYSIS | Classes: 10 |
|---|---|---|

Statement of Buckingham's π- theorem, similarity parameters - Reynolds number, Froude number, concepts of geometric, kinematic and dynamic similarity, Reynolds number as a very approximate measure of ratio of inertia force and viscous force.

Types of fluid flows, differential equations of mass and momentum for incompressible flows, inviscid-eulers equation and viscous flows- navier stokes equations, concept of fluid rotation, vorticity and stream function, exact solutions of navier stokes equations for coquette flow and poiseuille flow, numericals.

| MODULE -III | FLUID DYNAMICS | Classes: 10 |
|---|---|---|

Fluid forces and Motion of a fluid particle; Fluid deformation; Euler's and Bernoulli's equation, phenomenological basis of Naviers- stokes equation, flow measurements : pressure, velocity and mass flow rate, viscosity, pitot-static tube, venturi meter, orifice meter and V-Notch, numericals.

| MODULE -IV | BOUNDARY LAYER THEORY | Classes: 09 |
|---|---|---|

Concept and assumptions, qualitative idea of boundary layer and separation, streamlined and bluff bodies, drag and lift forces. Displacement, momentum and energy thickness, numericals.

| MODULE -V | TURBO MACHINERY | Classes: 09 |
|---|---|---|

Introduction and classification of fluid machines: Turbo machinery analysis; The angular momentum principle; Euler turbo machine equation; Application to fluid systems, working principle overview of turbines, fans, pumps and compressors.

**Text Books:**

1. D.J Tritton, “Physical Fluid Dynamics”, Oxford university press, 2nd edition 2016.
2. R. K Bansal, “Fluid mechanics and hydraulic machines”, Laxmi publications ltd, 9th Edition, 2011.
3. Robert W Fox, Alan T McDonald, “Introduction to fluid Mechanics”, John Wiley and Sons, 6th Edition, 1995.
4. Streeter V. L, Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 9th Edition, 1983.

**Reference Books:**

1. Yuan S W, “Foundations of fluid Mechanics”, Prentice-Hall, 2nd Edition, 1987.
2. Milne Thompson L M, “Theoretical Hydrodynamics”, MacMillan, 5th Edition, 1968.
3. Rathakrishnan. E, “Fundamentals of Fluid Mechanics”, Prentice-Hall, 5th Edition, 2007.
4. Som S. K, Biswas. G, “Introduction to fluid mechanics and fluid machines”, Tata McGraw-Hill, 2nd Edition, 2004.

**Web References:**

1. https://nptel.ac.in/courses/112105171/1
2. https://textofvideo.nptel.iitm.ac.in/112105171/lec1.pdf
3. https://www.fkm.utm.my/~syahruls/3-teaching/2-fluid-II/fluid-II-enote/32-pump-2.pdf
4. https://www.scribd.com/doc/16605891/Fluid-Mechanics

**E-Text Books:**

1. https://bookboon.com/en/engineering-fluid-mechanics-ebook
2. https://www.slideshare.net/asifzhcet/fluid-mechanics-and-hydraulic-machines-dr-r-k-bansal
3. https://eprints.staffs.ac.uk/222/1/engineering-fluid-mechanics%5B1%5D.pdf
4. https://www.engr.uky.edu/~acfd/me330-lctrs.pdf

**Course Home Page:**

# MECHANICS OF SOLIDS

**III Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB04 | Core | 3 | - | - | 3 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand various aspects of mechanics of materials as applied to engineering problems in a systematic manner stressing the fundamentals.
II. Analyze problems on thermal stresses, shear force, bending moment and deflection of beams
III. Discuss the equilibrium and compatibility conditions for two-dimensional and three-dimensional elastic bodies.

| MODULE -I | INTRODUCTION | Classes: 10 |
|---|---|---|

Properties of Engineering materials, Stresses and strains, Hooke's law, elastic constant, relation between module, working stress, factor of safety, poisons ratio, bars of varying cross section; Thermal stresses. Torsion of solid and hollow circular shafts and shear stress variations, Power transmission in shafts.Shear force and bending moment diagrams for different types of beams with various loads.

| MODULE -II | STRESSES IN BEAMS | Classes: 09 |
|---|---|---|

Bending stresses and Shear stress variation in beams of symmetric and un-symmetric sections, Beams of uniform strength, Flexural stresses: Bending equations, calculation of bending stresses for different sections of beams like I, L, T, C, angle section.

| MODULE -III | BEAMS AND COLUMNS | Classes: 09 |
|---|---|---|

Deflection of beams by Double integration method, Macaulay's method, moment area method, conjugate beam method; Principle of superposition.

Columns, types of columns, Euler's formula instability of columns, Rakine's and Jonson's formula, Eigen values and Eigen modes, concept of beam-column.

| MODULE -IV | REDUNDANT STRUCTURES | Classes: 08 |
|---|---|---|

Trusses, perfect frames, analysis of trusses, Determinate and indeterminate structures, order of redundancy; Redundant analysis, analysis of determinate structures, Clayperons method, slope deflection method.

| MODULE -V | THEORY OF ELASTISITY | Classes: 09 |
|---|---|---|

Equilibrium and compatibility conditions and constitute relations for elastic solid and plane: generalized plane strain cases Airy's stress function

Stress on inclined planes, stress transformations determination of principal stresses and strains by analytical method and graphical method - Mohr's circles and its constructions.

**Text Books:**

1. B C Punmia, "Mechanics of Materials", Laxmipublications (P) Ltd, 2006.
2. T. H. G. Megson, "Aircraft Structures for Engineering Students", Butterworth-Heinemann Ltd, 5th Edition, 2012.
3. Gere, Timoshenko, "Mechanics of Materials", McGraw Hill, 3rd Edition, 1993.

**Reference Books:**

1. R. K Bansal, "Strength of Materials", Laxmi publications, 5th Edition, 2012.
2. Dym, C. L, Shames, I. H, "Solid Mechanics", McGraw Hill, Kogakusha, Tokyo, 7th Edition, 2007.
3. Stephen Timoshenko, "Strength of Materials", Vol I & II, CBS Publishers and Distributors, 3rd Edition, 2004.
4. R. K. Rajput, "Strength of Materials", S. Chand and Co., 1st Edition, 1999.
5. Timoshenko, S, Young, D. H. "Elements of Strength of Materials", T. Van Nostrand Co. Inc., Princeton N.J, 4th Edition, 1977.

**Web References:**

1. www.nptel.ac.in/courses/112107147/
2. www.vssut.ac.in/lecture_notes/lecture1423904647.pdf
3. www.web.mit.edu/emech/dontindex-build/

**E-Text Books:**

1. www.e-booksdirectory.com/listing.php?category=456
2. www.esag.harvard.edu/rice/e0_Solid_Mechanics_94_10.pdf
3. www.itiomar.it/pubblica/dispense/MECHANICAL%20ENGINEERING%20HANDBOOK/

**Course Home Page:**

# FLUID DYNAMICS LABORATORY

**III Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB05 | Core | - | - | 2 | 1 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 24 | | | | Total Classes: 24 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Gain knowledge on working of centrifugal pumps, positive displacement pumps, hydraulic turbines centrifugal blowers and steam turbines.
II. Compare performance of various machines at different operating points.
III. Knowledge of various flow meters and the concept of fluid mechanics.

## LIST OF EXPERIMENTS

| | |
|---|---|
| **Week-1** | **CALIBRATION** |
| Calibration of Venturimeter and Orifice meter. | |
| **Week-2** | **PIPE FLOW LOSSES** |
| Determination of pipe flow losses in rectangular and circular pipes | |
| **Week-3** | **BERNOULLI'S THEOREM** |
| Verification of Bernoulli's theorem. | |
| **Week-4** | **REYNOLDS EXPERIMENT** |
| Determination of Reynolds Number of fluid flow | |
| **Week-5** | **IMPACT OF JET ON VANES** |
| Study Impact of jet on Vanes. | |
| **Week-6** | **CENTRIFUGAL PUMPS** |
| Performance test on centrifugal pumps. | |
| **Week-7** | **RECIPROCATING PUMPS** |
| Performance test on reciprocating pumps. | |
| **Week-8** | **PELTON WHEEL TURBINE** |
| Performance test on piston wheel turbine. | |
| **Week-9** | **FRANCIS TURBINE** |
| Performance test on Francis turbine. | |

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|---|---|
| **Week-10** | **FLOW THROUGH WEIRS** |
| Rate of discharge Flow through Weirs | |
| **Week-11** | **FLOW THROUGH NOTCH** |
| Flow through rectangular and V-Notch | |
| **Week-12** | **FLOW THOUGH ORIFICE MOUTH PIECE** |
| Flow analysis of different shapes of mouth pieces | |

**Reference Books:**


1. Yuan S W, "Foundations of fluid Mechanics", Prentice-Hall, 2nd Edition, 1987.
2. Milne Thompson L M, "Theoretical Hydrodynamics", MacMillan, 5th Edition, 1968.
3. Rathakrishnan. E, "Fundamentals of Fluid Mechanics", Prentice-Hall, 5th Edition, 2007.
4. Som S. K., Biswas. G, "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd Edition, 2004.


**Web References:**

1. https://nptel.ac.in/courses/112105171/1
2. https://textofvideo.nptel.iitm.ac.in/112105171/lec1.pdf
3. https://www.fkm.utm.my/~syahruls/3-teaching/2-fluid-II/fluid-II-enote/32-pump-2.pdf
4. https://www.scribd.com/doc/16605891/Fluid-Mechanics

**Course Home Page:**

# MECHANICS OF SOLIDS LABORATORY

**III Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB06 | Core | - | - | 2 | 1 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 24 | | | | Total Classes: 24 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand basic knowledge on the mechanical behavior of materials like aluminum, mild steel, and cast iron.

II. Adopt with the experimental methods to determine the mechanical properties of materials.

## LIST OF EXPERIMENTS

**Week-1 BRINELL HARDNESS TEST**

Determination of Brinell number of a given test specimen.

**Week-2 ROCKWELL HARDNESS TEST**

Determination of hardness number of different specimens such as steel, brass, copper and aluminum.

**Week-3 TENSION TEST**

Study the behavior of mild steel and various materials under different loads.

To determine

a) Tensile
b) Yield strength
c) Elongation
d) Young's modulus

**Week-4 TORSION TEST**

Determine of Modulus of rigidity of various specimens.

**Week-5 IZOD IMPACT TEST**

Determination the toughness of the materials like steel, copper, brass and other alloys using Izod test

**Week-6 CHARPY IMPACT TEST**

Determine the toughness of the materials like steel, copper, brass and other alloys using Charpy test.

**Week-7 COMPRESSION TEST ON SHORT COLUMN**

Determine the compressive stress on material.

**Week-8 COMPRESSION TEST ON LONG COLUMN**

Determine Young's modulus of the given long column.

| | |
|---|---|
| **Week-9** | **TESTING OF SPRINGS** |
| Determine the stiffness of the spring and the Modulus of rigidity of wire material. | |
| **Week-10** | **DEFLECTION TEST FOR SSB AND CANTILEVER BEAM** |
| Determine the Young's modulus of the given material with the help of deflection of SSB and cantilever beam. | |
| **Week-11** | **REVIEW - I** |
| Spare session for additional repetitions and review. | |
| **Week-12** | **REVIEW - II** |
| Spare session for additional repetitions and review. | |

**Reference Books:**


1. Gere, Timoshenko, "Mechanics of Materials", McGraw Hill, 3rd Edition, 1993.
2. R. S Kurmi, Gupta, "Strength of Materials", S. Chand, 24th Edition, 2005.
3. William Nash, "Strength of Materials", Tata McGraw Hill, 4th Edition, 2004.


**Web References:**

1. https://nptel.ac.in/courses/112107147/
2. https://vssut.ac.in/lecture_notes/lecture1423904647.pdf
3. https://web.mit.edu/emech/dontindex-build/

**Course Home Page:**

# OBJECT ORIENTED PROGRAMMING THROUGH PYTHON LABORATORY

**III Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AITB08 | Core | 1 | 0 | 2 | 2 | 30 | 70 | 100 |
| Contact Classes: 12 | Tutorial Classes: Nil | Practical Classes: 24 | | | | Total Classes: 36 | | |

**COURSE OBJECTIVES:**

The course should enable the students to:

**I.** To be able to introduce core programming basics and program design with functions using Python programming language.

**II.** To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.

**III.** To understand the high-performance programs designed to strengthen the practical expertise.

## LIST OF EXPERIMENTS

**WEEK-1 BASICS OF PYTHON**

Write Python programs for the following:

a. Purposefully raise Indentation Error and Correct it
b. Compute distance between two points taking input from the user (Pythagorean Theorem)
c. To takes numbers as command line arguments and print its sum.

**WEEK-2 CONTROL FLOW**

Write Python programs for implementing the following:

a. Checking whether the given number is even number or not.
b. Finding the factorial of a number
c. Print the prime numbers below 100

**WEEK-3 STRINGS**

Write Python programs for implementing the following:

a. Count the numbers of characters in the string and store them in a dictionary data structure
b. Using split and joins methods in the string and trace a birthday with a dictionary data structure.

**WEEK-4 LIST**

Write Python programs to for the following:

a. Finding mean, median, mode for the given set of numbers in a list.
b. Function dups to find all duplicates in the list.

**WEEK-5 MULTI DIMENSIONAL LIST**

Write Python programs for the following:

a. Addition of two square matrices.
b. Multiplication of two matrices.

**WEEK-6 CLASS**

Write Python programs to implement the following

i. Find the validity of a string of parentheses, '(', ')', '{', '}', '[' and ']. These brackets must be close in the

| |
|---|
| correct order, for example "()" and "()[]{}" are valid but "[)", "({[)]" and "{{{" are invalid.<br>ii. Get all possible unique subsets from a set of distinct integers. |
| **WEEK-7** **METHODS** |
| Write Python programs to do the following<br>i. Create a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle.<br>ii. Create a Python class named Rectangle constructed by a length and width and a method which will compute the area of a rectangle. |
| **WEEK-8** **CONSTRUCTORS** |
| Write Python program to implement constructors. |
| **WEEK-9** **INHERITANCE** |
| Write Python program to implement inheritance. |
| **WEEK-10** **POLYMORPHISM** |
| Write Python program to implement Polymorphism. |
| **WEEK-11** **OVERRIDING MAGIC METHODS** |
| Write Python program to override Magic Methods |
| **WEEK-12** **EVENT-DRIVEN PROGRAMMING** |
| Write Python program to create a simple calculator, where the user will enter a number in a text field, and either add it to or subtract it from a running total, which we will display. We will also allow the user to reset the total. |
| **LIST OF REFERENCE BOOKS:** |
| 1. Rance D. Necaise, "Object-Oriented Programming in Python Documentation Release 1", University of Cape Town and individual contributors, 2017. |
| **WEB REFERENCES:** |
| 1. https://www.w3resource.com/python-exercises/class-exercises/<br>2. https://www.rithmschool.com/courses/python-fundamentals-part-2/python-object-oriented-programming-exercises |

# AEROSPACE STRUCUTRES

**IV Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB07 | 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 aircraft structural components and its behavior under different loading conditions.
II. Obtain knowledge in plate buckling and structural instability of stiffened panels for airframe structural analysis.
III. Explain the thin walled section and structural idealization of panels and differentiate from the type of loads carried.
IV. Solve for stresses and deflection in aircraft structures like fuselage, wing and landing gear.

| MODULE -I | INTRODUCTION TO AIRCRAFT STRUCTURAL COMPONENTSAND ENERGY METHODS | Classes: 10 |
|---|---|---|

Aircraft Structural components and loads, functions of structural components, airframe loads; Types of structural joints, type of loads on structural joints; Aircraft inertia loads; Symmetric manoeuvre loads, gust loads. Monocoque and semi monocoque structures, stress in thinshells; Introductions to energy principles, castiglianos theorems, maxiwells reciprocal theorem, unit load method, Rayleigh Ritz method, total potential energy method, flexibility method.

| MODULE -II | THIN PLATE THEORY, STRUCTURAL INSTABILITY | Classes: 09 |
|---|---|---|

Analysis of thin rectangular plates subject to bending, twisting, distributed transverse load, combined bending and in-plane loading: Thin plates having small initial curvature, energy methods of analysis.
Buckling of thin plates: Elastic, inelastic, experimental determination of critical load for a flat plate, local instability, instability of stiffened panels, failure stresses in plates and stiffened panels. Tension field beams- complete diagonal tension, incomplete diagonal tension, post buckling behavior.

| MODULE -III | BENDING, SHEAR AND TORSION OF THIN WALLED BEAMS | Classes: 09 |
|---|---|---|

Unsymmetrical bending: Resolution of bending moments, direct stress distribution, position of neutral axis; Deflections due to bending: Approximations for thin walled sections, temperature effects; Shear loaded thin walled beams: General stress, strain and displacement relationships, direct stress and shear flow system, shear centre, twist and warping.

Torsion of beams of closed section: Displacements associated with Bredt-Batho shear flow; Torsion of open section beams; Warping of cross section, conditions for zero warping; Bending, shear, torsion of combined open and closed section beams.

| MODULE -IV | STRUCTURAL IDEALIZATION | Classes: 08 |
|---|---|---|

Structural idealization: Principal assumptions, idealization of panel, effect on the analysis of thin walled beams under bending, shear, torsion loading- application to determining deflection of open and closed section beams. Fuselage frames - bending, shear and torsion.

| MODULE -V | ANALYSIS OF FUSELAGE, WING AND LANDING GEAR | Classes: 09 |
|---|---|---|
| Wing spar and box beams, tapered wing spar, open and closed sections beams, beams having variable stringer areas; wings – three boom shell in bending, torsion and shear, tapered wings, deflections, cutouts in wings; Cutouts in fuselages; Fuselage frame and wing rib; principle of stiffener, web constructions. Landing gear and types; Analysis of landing gear. | | |
| **Text Books:** | | |
| 1. T. H. G. Megson, "Aircraft Structures for Engineering Students", Butterworth-Heinemann Ltd, 5th Edition, 2012.<br>2. E. H. Bruhn, "Analysis and Design of Flight vehicles Structures", Tri-state off set company, USA, 4th Edition, 1965. | | |
| **Reference Books:** | | |
| 1. B. K. Donaldson, "Analysis of Aircraft Structures - An Introduction", Mc Graw Hill, 3rd Edition, 1993.<br>2. S. Timoshenko, "Strength of Materials, Vols I and II", Princeton D. Von Nostrand Co., Reprint, 1977. | | |
| **Web References:** | | |
| 1. https://nptel.ac.in/courses/112101095/<br>2. https://www.scribd.com/doc/244154727/theory-of-structures-timoshenko-pdf | | |
| **E-Text Books:** | | |
| 1. https://www.freeengineeringbooks.com/AeroSpace/Aircraft-Structures-Books.php<br>2. https://docs.google.com/file/d/0Bw8MfqmgWLS4RlNqaE1oUzdOajQ/view?pref=2&pli=1 | | |
| **Course Home Page:** | | |

# DATA STRUCTURES

**III Semester: ME / CSE / IT / ECE / CE | IV Semester: AE / EEE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| ACSB03 | 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.** Learn the basic techniques of algorithm analysis.
- **II.** Demonstrate searching and sorting algorithms and analyze their time complexities.
- **III.** Implement linear data structures viz. stack, queue and linked list.
- **IV.** Demonstrate non-linear data structures viz. tree and graph traversal algorithms.
- **V.** Study and choose appropriate data structure to solve problems in real world.

| MODULE – I | INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING | Classes: 09 |
|---|---|---|

Basic concepts: Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms, different approaches to design an algorithm, recursive algorithms; Searching techniques: Linear search, binary search and Fibonacci search; Sorting techniques: Bubble sort, selection sort, insertion sort, quick sort, merge sort, and comparison of sorting algorithms

| MODULE - II | LINEAR DATA STRUCTURES | Classes: 09 |
|---|---|---|

Stacks: Primitive operations, implementation of stacks using Arrays, applications of stacks arithmetic expression conversion and evaluation; Queues: Primitive operations; Implementation of queues using Arrays, applications of linear queue, circular queue and double ended queue (deque).

| MODULE - III | LINKED LISTS | Classes: 09 |
|---|---|---|

Linked lists: Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list; Applications of linked lists: Polynomial representation and sparse matrix manipulation

Types of linked lists: Circular linked lists, doubly linked lists; Linked list representation and operations of Stack, linked list representation and operations of queue.

| MODULE - IV | NON LINEAR DATA STRUCTURES | Classes: 09 |
|---|---|---|

Trees: Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary tree variants, application of trees; Graphs: Basic concept, graph terminology, graph implementation, graph traversals, Application of graphs, Priority Queue.

| MODULE - V | BINARY TREES AND HASHING | Classes: 09 |
|---|---|---|

Binary search trees: Binary search trees, properties and operations; Balanced search trees: AVL trees; Introduction to M-Way search trees, B trees; Hashing and collision: Introduction, hash tables, hash functions, collisions, applications of hashing.

| **Text Books:** |
|---|
| 1. Rance D. Necaise, “Data Structures and Algorithms using Python”, Wiley Student Edition.<br>2. Benjamin Baka, David Julian, “Python Data Structures and Algorithms”, Packt Publishers, 2017. |
| **Reference Books:** |
| 1. S. Lipschutz, “Data Structures”, Tata McGraw Hill Education, 1st Edition, 2008.<br>2. D. Samanta, “Classic Data Structures”, PHI Learning, 2nd Edition, 2004.<br>3. Y Daniel Liang, “Introduction to Programming using Python”, Pearson. |
| **Web References:** |
| 1. https://www.tutorialspoint.com/data_structures_algorithms/algorithms_basics.htm<br>2. https://www.codechef.com/certification/data-structures-and-algorithms/prepare<br>3. https://www.cs.auckland.ac.nz/software/AlgAnim/ds_ToC.html<br>4. https://online-learning.harvard.edu/course/data-structures-and-algorithms |

# AEROSPACE PROPULSION

**IV Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB08 | Core | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Analyze parametric cyclic analysis, performance parameters, efficiency and specific impulse of all air breathing engines.
II. Know the design and performance of subsonic and supersonic inlets, types of combustion chambers and factors affecting the combustors.
III. Discuss the types of nozzles, flow conditions in nozzles, interaction of nozzle flow with adjacent surfaces and thrust reversal
IV. Explain different types of compressors and turbines, work done, velocity diagrams and stage efficiency calculations.

| MODULE -I | AIR-BREATHING ENGINES | Classes: 10 |
|---|---|---|

Classification, operational envelopes; Description and function of gas generator, turbojet, turbofan, turboprop, turbo shaft, ramjet, scramjet, turbojet/ramjet combined cycle engine, thrust equation; Engine performance parameters, specific thrust, specific fuel consumption and specific impulse, thermal efficiency, propulsive efficiency, engine overall efficiency and its impact on aircraft range and endurance; Parametric cycle analysis a, turbojet, turbojet with afterburner, turbofan engine, turboprop engine.

| MODULE -II | INLETS AND COMBUSTION CHAMBERS | Classes: 10 |
|---|---|---|

Internal flow and stall in subsonic inlets, relation between minimum area ratio and eternal deceleration ratio, diffuser performance, supersonic inlets, operating conditions of supersonic inlet, starting problem on supersonic inlets, shock swallowing by area variation; Classification of combustion chambers, Combustion mechanism and important combustion parameters. Pressure losses; combustion efficiency; combustion intensity. Factors affecting combustion chamber design, and operation, flame stabilization.

| MODULE -III | NOZZLES | Classes: 08 |
|---|---|---|

Theory of flow in isentropic nozzles, nozzles and choking, nozzle throat conditions, nozzle efficiency, losses in nozzles.

Over expanded and under expanded nozzles, Nozzle design considerations: fixed and variable geometry nozzles, thrust vectoring, thrust reversal.

| MODULE -IV | COMPRESSORS | Classes: 09 |
|---|---|---|

Principle of operation of centrifugal compressor and axial flow compressor, work done and pressure rise, velocity triangles, degree of reaction, free vortex and constant reaction designs of axial flow compressor, performance characteristics of centrifugal and axial flow compressors, stage efficiency calculations, cascade testing.

| MODULE -V | TURBINES | Classes: 08 |
|---|---|---|
| Principle of operation of axial flow turbines, limitations of radial flow turbines, work done and pressure rise, velocity triangles, degree of reaction, free vortex and constant angle designs, performance characteristics, sample ramjet design calculations, flame stability problems in ramjet combustors, integral ram rockets. | | |

**Text Books:**

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison Wesley Longman INC, 1999.
2. Mattingly J.D., "Elements of Propulsion: Gas Turbines and Rocket", AIAA, 1991.

**Reference Books:**

1. Cohen, H.Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman, 1989.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.

**Web References:**

1. https://nptel.ac.in/courses/101101002/
2. https://nptel.ac.in/courses/112106073/

**E-Text Books:**

1. https://as.wiley.com/WileyCDA/WileyTitle/productCd-1118806778.html
2. https://www.scribd.com/document/63588270/Aerospace-Propulsion-Systems
3. https://www.crcpress.com/Aircraft-Propulsion-and-Gas-Turbine-Engines/ElSayed/p/book/9780849391965

**Course Home Page:**

# FLIGHT MECHANICS

**IV Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB09 | Core | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Learn the different Regimes of aircraft and performance requirements at different atmospheric conditions.
II. Understand the different type of velocities and gives differences between stall velocity and maximum and minimum velocities.
III. Estimate the time to climb and descent and gives the relation between rate of climb and descent and time to climb and descent at different altitudes.
IV. Illustrate the velocity and radius required for different type of maneuvers like pull-up, pull down and steady turn.

| MODULE -I | INTRODUCTION TO AIRCRAFT PERFORMANCE | Classes: 10 |
|---|---|---|

The role and design mission of an aircraft; Performance requirements and mission profile; Aircraft design performance, the standard atmosphere; Off-standard and design atmosphere; Measurement of air data; Air data computers; Equations of motion for performance - the aircraft force system; Total airplane drag-estimation, drag reduction methods; The propulsive forces, the thrust production engines, power producing engines, variation of thrust, propulsive power and specific fuel consumption with altitude and flight speed; The minimum drag speed, minimum power speed; Aerodynamic relationships for a parabolic drag polar.

| MODULE -II | CRUISE PERFORMANCE | Classes:08 |
|---|---|---|

Maximum and minimum speeds in level flight; Range and endurance with thrust production, and power producing engines; Cruise techniques: constant angle of attack, constant mach number; constant altitude, methods- comparison of performance. The effect of weight, altitude and temperature on cruise performance; Cruise performance with mixed power-Plants.

| MODULE -III | CLIMB AND DECENT PERFORMANCE | Classes: 10 |
|---|---|---|

Importance of Climb and descent performance, Climb and descent technique generalized performance analysis for thrust producing, power producing and mixed power plants, maximum climb gradient, and climb rate.

Energy height and specific excess power, energy methods for optimal climbs - minimum time, minimum fuel climbs. Measurement of best climb performance. Descent performance in Aircraft operations. Effect of wind on climb and decent performance.

| MODULE -IV | AIRCRAFT MANOEUVRE PERFORMANCE | Classes: 09 |
|---|---|---|

Lateral maneuvers- turn performance- turn rates, turn radius- limiting factors for turning performance. Instantaneous turn and sustained turns, specific excess power, energy turns. Longitudinal aircraft maneuvers, the pull-up, maneuvers. The maneuver envelope (V-n diagram), Significance. Maneuver boundaries and limitations, Maneuver performance of military Aircraft, transport Aircraft.

| MODULE -V | SAFETY REQUIREMENTS -TAKEOFF AND LANDING PERFORMANCE AND FLIGHT PLANNING | Classes:08 |
|---|---|---|

Estimation of takeoff distances. The effect on the takeoff distance of weight wind, runway conditions, ground effect. Takeoff performance safety factors. Estimation of landing distances. The discontinued landing, Baulk landing, air safety procedures and requirements on performance. Fuel planning fuel requirement, trip fuel, Environment effects, reserve, and tinkering**.**

**Text Books:**

1. Anderson, J.D. Jr., "Aircraft Performance and Design", International edition McGraw Hill, 1st Edition, 1999, ISBN: 0-07-001971-1.
2. Eshelby, M.E., "Aircraft Performance theory and Practice", AIAA Education Series, AIAA, 2nd Edition, 2000, ISBN: 1-56347-398-4.

**Reference Books:**

1. McCormick, B.W, "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, 2nd Edition, 1995, ISBN: 0-471-57506-2.
2. Yechout, T.R. et al., "Introduction to Aircraft Flight Mechanics", AIAA Education Series, AIAA, 1st Edition, 2003, ISBN: 1-56347-577-4.
3. Shevel, R.S., "Fundamentals of Flight", Pearson Education, 2nd Edition, 1989, ISBN: 81-297-0514-1.

**Web References:**

1. www.myopencourses.com/subject/flight-dynamics-i-airplane-performance
2. www.scribd.com/doc/185026212/Introduction-to-Flight-Third-Edition-by-John-D-Anderson-Jr
3. www.scribd.com/book/282507871/Performance-and-Stability-of-Aircraft
4. www.scribd.com/doc/203462287/Aircraft-Performance-NPTEL
5. www.nptel.ac.in/courses/101106041/

**E-Text Books:**

1. www.scribd.com/doc/97544751/Anderson-Aircraft-Performance-and-Design

**Course Home Page:**

# AERODYNAMICS

**IV Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB10 | Core | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand the basics of aerodynamics, aerofoil and wing characteristics
II. Calculate forces and moments acting on aero foils and wings under ideal flow conditions.
III. Design a propeller and determine aerodynamic interaction effects between different components of aircraft.

| MODULE -I | INTRODUCTORY TOPICS FOR AERODYNAMICS | Classes: 09 |
|---|---|---|

Potential flow, velocity potential, stream function, Laplace equation, flow singularities-Uniform flow, source, sink, doublet, Vortex, Non lifting and lifting flow over a cylinder Kutta-Joukowski theorem.

| MODULE -II | THIN AEROFOIL THEORY | Classes: 09 |
|---|---|---|

Aerofoil nomenclature, aerodynamic characteristics, centre of pressure and aerodynamic centre; Wing of infinite aspect ratio, $C_L$-α- diagram for a wing of infinite aspect ratio, generation of lift, starting Vortex, Kutta's trailing edge condition; Thin aerofoil theory; Elements of panel method; High lift airfoils, High lift devices.

| MODULE -III | FINITE WING THEORY | Classes: 12 |
|---|---|---|

Vortex motions, vortex line, vortex tube, vortex sheet; Circulation; Kelvin and Helmhotz theorem; Biot-Savart's law, applications, Rankine's vortex; Flow past finite wings, vortex model of the wing and bound vortices; Induced drag; Prandtl's lifting line theory; Elliptic wing.

Influence of taper and twist applied to wings, effect of sweep back wings; Delta wings, primary and secondary vortex; Elements of lifting surface theory. Source Panel Vortex panel and Vortex lattice methods.

| MODULE -IV | FLOW PAST NON-LIFTING BODIES AND INTERFERENCE EFFECTS | Classes: 08 |
|---|---|---|

Flow past non lifting bodies, method of singularities; Wing-body interference; Effect of propeller on wings and bodies and tail unit; Flow over airplane as a whole.

| MODULE -V | BOUNDARY LAYERTHEORY | Classes: 07 |
|---|---|---|

Introduction to boundary layer, laminar and turbulent boundary layer, transition, boundary layer on flat plate, displacement thickness, momentum thickness, energy thickness, effect of curvature, temperature boundary layer.

**Text Books:**


1. E. L. Houghton and P. W. Carpenter, "Aerodynamics for Engineering Students", Edward Arnold Publishers Ltd., London, 5th Edition, 1982,
2. J. D. Anderson, "Fundamentals of Aerodynamics", Mc Graw Hill Book Co., New York, 5th Edition, 1985.
3. John J. Bertin and Russell M. Cummings, "Aerodynamics for Engineering Students", Pearson, 5th Edition, 2009.

**Reference Books:**


1. L. J. Clancy, "Aerodynamics", Pitman, 1st Edition, 1986.
2. L. H. Milne, S. Thomson, "Theoretical Aerodynamics", Dover, 2nd Edition, 1985.
3. K. Karamcheti, "Principles of Ideal-Fluid Aerodynamics", Krieger Pub Co; 2nd edition, 1980.


**Web References:**

1. https://www.loc.gov/rr/scitech/tracer-bullets/aerodynamicstb.html
2. https://www.myopencourses.com/subject/aerodynamics-2
3. https://tocs.ulb.tu-darmstadt.de/211658790.pdf
4. https://www.princeton.edu/~stengel/MAE331Lecture3.pdf

**E-Text Books:**

1. https://bookboon.com/en/a-first-course-on-aerodynamics-ebook
2. https://airspot.ru/book/file/22/houghton_aerodynamics_for_engineering_students.pdf
3. https://www.adl.gatech.edu/extrovert/Ebooks/ebook_Lowspeed.pdf
4. https://rahauav.com/Library/Aerodynamic/Aerodynamics%20for%20engineering%20students_6th_www.rahauav.com.pdf

**Course Home Page:**

# ENVIRONMENTAL SCIENCE

**IV Semester: Common for all Branches**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AHSB07 | Foundation | 0 | 0 | 0 | 0 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: Nil | | | | Total Classes: Nil | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Analyze the interrelationship between living organism and environment.
II. Understand the importance of environment by assessing its impact on the human world.
III. Enrich the knowledge on themes of biodiversity, natural resources, pollution control and waste management.

| MODULE -I | ENVIRONMENT AND ECOSYSTEMS | Classes: 00 |
|---|---|---|

Environment: Definition, scope and importance of environment, need for public awareness; Ecosystem: Definition, scope and importance of ecosystem, classification, structure and function of an ecosystem, food chains, food web and ecological pyramids, flow of energy; Biogeochemical cycles; Biomagnifications.

| MODULE -II | NATURAL RESOURCES | Classes: 00 |
|---|---|---|

Natural resources: Classification of resources, living and nonliving resources; Water resources: Use and over utilization of surface and ground water, floods and droughts, dams, benefits and problems; Mineral resources: Use and exploitation; Land resources; Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

| MODULE -III | BIODIVERSITY AND BIOTIC RESOURCES | Classes: 00 |
|---|---|---|

Biodiversity and biotic resources: Introduction, definition, genetic, species and ecosystem diversity; Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and optional values; India as a mega diversity nation; Hot spots of biodiversity.

Threats to biodiversity: Habitat loss, poaching of wildlife, human-wildlife conflicts; Conservation of biodiversity: In situ and ex situ conservation; National biodiversity act.

| MODULE -IV | ENVIRONMENTAL POLLUTION, POLLUTION CONTROL TECHNOLOGIES AND GLOBAL ENVIRONMENTAL PROBLEMS | Classes: 00 |
|---|---|---|

Environmental pollution: Definition, causes and effects of air pollution, water pollution, soil pollution, noise pollution; Solid waste: Municipal solid waste management, composition and characteristics of e-waste and its management; Pollution control technologies: Waste water treatment methods, primary, secondary and tertiary; Concepts of bioremediation; Global environmental problems and global efforts: Climate change, ozone depletion, ozone depleting substances, deforestation and desertification; International conventions / protocols: Earth summit, Kyoto protocol and Montreal protocol.

| MODULE -V | ENVIRONMENTAL LEGISLATIONS AND SUSTAINABLE DEVELOPMENT | Classes: 00 |
|---|---|---|

Environmental legislations: Environmental protection act, air act1981, water act, forest act, wild life act, municipal solid waste management and handling rules, biomedical waste management and handling rules2016, hazardous waste management and handling rules, Environmental impact assessment(EIA); Towards sustainable future: Concept of sustainable development, population and its explosion, crazy consumerism, environmental education, urban sprawl, concept of green building.

**Text Books:**

1. Benny Joseph, "Environmental Studies", Tata Mc Graw Hill Publishing Co. Ltd, New Delhi, 1st Edition, 2006.
2. Erach Bharucha, "Textbook of Environmental Studies for Under Graduate Courses", Orient Black Swan, 2nd Edition, 2013.
3. Dr. P. D Sharma, "Ecology and Environment", Rastogi Publications, New Delhi, 12th Edition, 2015.

**Reference Books:**

1. Tyler Miller, Scott Spoolman, "Environmental Science", Cengage Learning, 14th Edition, 2012.
2. Anubha Kaushik, "Perspectives in Environmental Science", New Age International, New Delhi, 4th Edition, 2006.
3. Gilbert M. Masters, Wendell P. Ela, "Introduction to Environmental Engineering and Science, Pearson, 3rd Edition, 2007.

**Web References:**

1. https://www.elsevier.com
2. https://www. libguides.lib.msu.edu
3. https://www.fao.org
4. https://www nrc.gov
5. https://www istl.org
6. https://www.ser.org
7. https://www.epd.gov.
8. https://www.nptel.ac.in

**E-Text Books:**

1. http://www.ilocis.org
2. http://www.img.teebweb.org
3. http://www.ec.europa.eu
4. http://www.epa.ie
5. http://www.birdi.ctu.edu.vn

# AEROSPACE STRUCTURES LABORATORY

**IV Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB11 | Core | - | - | 3 | 1.5 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 36 | | | | Total Classes: 36 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Provide basic knowledge on the mechanical behavior of materials like aluminum, mild steel, and cast iron.
II. Visualize the crack detection using various NDT methods and also discuss the changing strength due to these defects.
III. Understand the concept of locating the shear centre for open and closed section of beams.
IV. Obtain buckling strength of both long and short columns using different elastic supports.

## LIST OF EXPERIMENTS

| | |
|---|---|
| **Week-1** | **DIRECT TENSION TEST** |
| Tensile testing using UTM, mechanical and optical extensometers, stress strain curves and strength test or various engineering materials. | |
| **Week-2** | **DEFLECTION TEST** |
| Stress and deflections of beams for various end conditions, verification of Maxwell's theorem | |
| **Week-3** | **BUCKLING TEST** |
| Compression tests on long columns, Critical buckling loads. | |
| **Week-4** | **BUCKLING TEST** |
| Compression tests on short columns, Critical buckling loads, south well plot. | |
| **Week-5** | **BENDING TEST** |
| Unsymmetrical Bending of a Beam. | |
| **Week-6** | **SHEAR CENTRE FOR OPEN SECTION** |
| Shear Centre of an open Section beam. | |
| **Week-7** | **SHEAR CENTRE FOR CLOSED SECTION** |
| Shear Centre of a closed Section beam. | |
| **Week-8** | **WAGNER'S THEOREM** |
| Wagner beam – Tension field beam. | |
| **Week-9** | **SANDWICH PANEL TENSION TEST** |
| Fabrication and determine the young's modulus of a sandwich structures. | |

| | |
|---|---|
| **Week-10** | **NON-DESTRUCTIVE TESTING** |
| Study of non-destructive testing procedures using dye penetration, | |
| **Week-11** | **NON-DESTRUCTIVE TESTING** |
| Magnetic particle inspection and ultrasonic techniques. | |
| **Week-12** | **VIBRATION TEST** |
| Determination of natural frequency of beams under free and forced vibration using. | |

**Reference Books:**


1. Megson, T.H.G., Aircraft Structures for Engineering Students, 4th edn., Elsevier, 2007, ISBN 0-750-667397.
2. Peery, D.J. and Azar, J.J., Aircraft Structures, 2nd edn, McGra-Hill, 1982, ISBN 0-07-049196-8.
3. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, Tri-state Off-set Company, USA, 1965.
4. Lakshmi Narasaiah, G., Aircraft Structures, BS Publications, 2010.


**Web References:**

1. httpa://nptel.ac.in/courses/112101095/
2. https://www.scribd.com/doc/244154727/theory-of-structures-timoshenko-pdf

**Course Home Page:**

# AERODYNAMICS AND PROPULSIONLABORATORY

**IV Semester: AE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AAEB12 | Core | - | - | 2 | 1 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 24 | | | | Total Classes: 24 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand the behavior of flow properties over different models using subsonic wind tunnel.
II. Demonstrate experimentally the pressure distribution over circular, symmetric and cambered airfoils and evaluate lift and drag.
III. Illustrate flow visualization studies at low speeds over different aerodynamic bodies.
IV. Understand the basics of propulsion, working principles of reciprocating engines, performance estimation based on rotation angles, and components of engine and their functions
V. Knowledge about the operation of valves, ports and their functioning in four stroke and two stroke engines.
VI. Calculation of percentage of carbon residue and flash and fire point temperatures of a Lubricating Oil.

## LIST OF EXPERIMENTS

| | |
|---|---|
| **Week-1** | **CALIBRATION AND PRESSURE DISTRIBUTION-CYLINDER** |
| Calibration of subsonic wind tunnel, Pressure distribution over cylinder. | |
| **Week-2** | **PRESSURE DISTRIBUTION AND FLOW VISUALIZATION -SYMMETRIC, CAMBERED AIRFOIL** |
| Pressure distribution and flow visualization over symmetric, cambered airfoil | |
| **Week-3** | **FORCE MEASUREMENT** |
| Force measurement using wind tunnel balance. | |
| **Week-4** | **WAKE ANALYSIS** |
| Wake analysis over a cylinder and airfoils | |
| **Week-5** | **FLOW OVER A FLAT PLATE** |
| Flow over a flat plate | |
| **Week-6** | **BLOWER TEST RIG** |
| Efficiency of blower test rig for 3 different vane settings. | |
| **Week-7** | **GAS TURBINE PARAMETERS CALCULATION** |
| Calculation of work, power and Thrust requirement in gas turbine- combustion power input, work heat relationship. | |
| **Week-8** | **GAS TURBINE EFFICIENCY AND PERFORMANCE DIAGRAMS** |
| Elucidate T-S, H-S diagrams for the gas turbine and compare efficiencies of non-ideal engine components. | |

| | |
|---|---|
| **Week-9** | **GAS TURBINE EFFICIENCY CALCULATIONS** |
| Calculation of thermal, propulsive and overall efficiency of turbo jet cycle. | |
| **Week-10** | **NOZZEL PERFORMECE** |
| Calculation of various nozzle performance with airflow | |
| **Week-11** | **CALORIFIC VALUE OF DIFFERENT FUELS** |
| Calculation of calorific value of different fuels and materials using digital bomb calorimeter and optimizing astute fuels | |
| **Week-12** | **PROPELLER TEST RIG** |
| Calculation of propeller efficiency and thrust availability using propeller test rig at various blade pitch angles. | |

**Reference Books:**


1. L. J. Clancy, "Aerodynamics", Pitman, 1st Edition, 1986.
2. Alan pope, "Low Speed Wind Tunnel Testing", John Wiley, 2nd Edition, 1999.
3. N. M. Komerath, "Low Speed Aerodynamics", Extrovert, 1st Edition, 2012.
4. https://www.cast-safety.org/pdf/3_engine_fundamentals.pdf
5. https://en.wikipedia.org/wiki/Reciprocating_engine


**Web References:**

1. www.loc.gov/rr/scitech/tracer-bullets/aerodynamicstb.html
2. www.myopencourses.com/subject/aerodynamics-2
3. www.tocs.ulb.tu-darmstadt.de/211658790.pdf
4. www.princeton.edu/~stengel/MAE331Lecture3.pdf

**Course Home Page:**

# DATA STRUCTURES LABORATORY

**III Semester: ME / CSE / IT / ECE / CE | IV Semester: AE / EEE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| ACSB05 | Foundation | - | - | 3 | 1.5 | 30 | 70 | 100 |
| Contact Classes: Nil | Tutorial Classes: Nil | Practical Classes: 36 | | | | Total Classes: 36 | | |

**OBJECTIVES:**

**The course should enable the students to:**

I. Understand various data representation techniques in the real world.
II. Implement linear and non-linear data structures.
III. Analyze various algorithms based on their time and space complexity.
IV. Develop real-time applications using suitable data structure.
V. Identify suitable data structure to solve various computing problems.

## LIST OF EXPERIMENTS

**WEEK-1 SEARCHING TECHNIQUES**

Write Python programs for implementing the following searching techniques.
a. Linear search
b. Binary search
c. Fibonacci search

**WEEK-2 SORTING TECHNIQUES**

Write Python programs for implementing the following searching techniques to arrange a list of integers in ascending order.
a. Bubble sort
b. Insertion sort
c. Selection sort

**WEEK-3 SORTING TECHNIQUES**

Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order.
a. Quick sort
b. Merge sort

**WEEK-4 IMPLEMENTATION OF STACK AND QUEUE**

Write Python programs to
a. Design and implement Stack and its operations using list.
b. Design and implement Queue and its operations using list.

**WEEK-5 APPLICATIONS OF STACK**

Write Python programs for the following:
a. Uses Stack operations to convert infix expression into postfix expression.
b. Uses Stack operations for evaluating the postfix expression.

| WEEK6 | IMPLEMENTATION OF SINGLE LINKED LIST |
|---|---|

a. Write Python programs for the following operations on Single Linked List.
(i) Creation
(ii) Insertion
(iii) Deletion
(iv) Traversal
b. To store a polynomial expression in memory using single linked list.

| WEEK-7 | IMPLEMENTATION OF CIRCULAR SINGLE LINKED LIST |
|---|---|

Write Python programs for the following operations on circular linked List.
(i) Creation
(ii) Insertion
(iii) Deletion
(iv) Traversal

| WEEK-8 | IMPLEMENTATION OF DOUBLE LINKED LIST |
|---|---|

Write Python programs for the following:
Uses functions to perform the following operations on Double Linked List.
(i) Creation
(ii) Insertion
(iii) Deletion
(iv) Traversal in both ways.

| WEEK-9 | IMPLEMENTATION OF STACK USING LINKED LIST |
|---|---|

Write a Python program to implement Stack using linked list.

| WEEK-10 | IMPLEMENTATION OF QUEUE USING LINKED LIST |
|---|---|

Write a Python program to implement Linear Queue using linked list.

| WEEK-11 | GRAPH TRAVERSAL TECHNIQUES |
|---|---|

Write Python programs to implement the following graph traversal algorithms:
a. Depth first search.
b. Breadth first search.

| WEEK-12 | IMPLEMENTATION OF BINARY SEARCH TREE |
|---|---|

Write a Python program to perform the following:
a. Create a binary search tree.
b. Traverse the above binary search tree recursively in pre-order, post-order and in-order.
c. Count the number of nodes in the binary search tree.

**LIST OF REFERENCE BOOKS:**


1. Y Daniel Liang, “Introduction to Programming using Python”, Pearson.
2. Benjamin Baka, David Julian, “Python Data Structures and Algorithms”, Packt Publishers,2017.
3. Rance D. Necaise, “Data Structures and Algorithms using Python”, Wiley Student Edition.
4. Martin Jones, “Python for Complete Beginners”, 2015.
5. Zed A. Shaw, “Learn Python the Hard Way: a very simple introduction to the terrifyinglybeautiful world of computers and code”, 3e, Addison-Wesley, 2014.
6. Hemant Jain, “Problem Solving in Data Structures and Algorithms using Python: programming interview guide”, 2016.

| WEB REFERENCES: |
| --- |
| 1. https://docs.python.org/3/tutorial/datastructures.html<br>2. http://interactivepython.org/runestone/static/pythonds/index.html<br>3. http://www.tutorialspoint.com/data_structures_algorithms<br>4. http://www.geeksforgeeks.org/data-structures/<br>5. http://www.studytonight.com/data-structures/<br>6. http://www.coursera.org/specializations/data-structures-algorithms |

# 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.

# B.TECH - PROGRAM OUTCOMES (POS)

**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 AERONAUTICAL ENGINEERING

## PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

A graduate of the Aeronautical Engineering Program should:

**PEO – I**: To prepare and provide student with an academic environment for students to excel in postgraduate programs or to succeed in industry / technical profession and the life-long learning needed for a successful professional career in Aeronautical Engineering and related fields (**Preparation & Learning Environment**).

**PEO – II:** To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies (**Core Competence**).

**PEO – III:** To train students with good scientific and engineering breadth so as to comprehend, analyze, design, and create novel products and solutions for the real life problems (**Breadth**).

**PEO – IV:** To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context (**Professionalism)**.

## PROGRAM SPECIFIC OUTCOMES (PSO's)

**PSO – I:** **Professional skills**: Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products.

**PSO – II:** **Professional skills:** Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles

**PSO – III:** **Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies

**PSO-IV: Successful Career And Entrepreneurship:** To Prepare The Students With Broad Aerospace Knowledge To Design And Develop Systems And Subsystems Of Aerospace And Allied Systems And Become Technocrats

# FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

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

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

**2 Shall IARE award its own Degrees?**

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

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

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

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

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

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

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

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

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

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

No. IARE has 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 program?**

These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

**16 What is a Semester Grade Point Average (SGPA)?**

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

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

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

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

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

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

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. CGPA is rounded to two decimal places.

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

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

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

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

**20 Will there be any Revaluation or Re-Examination System?**

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

**21 How fast Syllabi can be and should be changed?**

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

**22 Will the Degree be awarded on the basis of only final year performance?**

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

**23 What are Statutory Academic Bodies?**

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body 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 Boared 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 preparation of Grade Sheet 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 Programs also?**

Yes, presently our PG programs also enjoying autonomous status.

# MALPRACTICES RULES

## DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

| S.No | **Nature of Malpractices/Improper conduct** | **Punishment** |
|---|---|---|
| | *If the candidate:* | |
| 1. (a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculator, cell phone, pager, palm computer 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.<br>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 off 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.<br><br>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 / III Semester for the academic year 2018-2019 / 2019-2020 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/laboratory/project) and secure attendance of not less than 75% in every course as stipulated by Institute. I am fully aware that an attendance of less than 65% in more than 60% of theory courses in a semester 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 - R18 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

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### ACKNOWLEDGEMENT

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

**Signature of Student with Date**

**Signature of Parent with Date**
**Name & Address with Phone Number**