# RAJIV GANDHI NATIONAL AVIATION UNIVERSITY

*(Established by Act of Parliament 2013)*

Fursatganj, Amethi-229302, Uttar Pradesh (India).

**Bachelor of Technology (B. Tech)**
**Four Years UG Degree Programme**
Academic Regulations, Programme Structure & Syllabi

**With Effect From**
**Academic Year 2025-26**

## Contents

# Bachelor of Technology (B.Tech.) AeroSpace Engineering
# Four Years UG Degree Programme
Academic Regulations

**Preface:**

The Rajiv Gandhi National Aviation University (RGNAU) was established by an Act of Parliament called the "Rajiv Gandhi National Aviation University (RGNAU) Act, 2013" (No. 26 of 2013) having its headquarters at Fursatganj, Dist. Amethi, Uttar Pradesh. The University has been envisaged as the premier institution of higher learning within the aviation milieu aimed at providing cutting edge and critical research to enhance the aviation industry in India. The Act of Parliament empowers the University to award Diploma, Under Graduate Degrees, Post Graduate Degrees and PhD degrees in the field of aviation and allied disciplines. At the same time collaborations and cooperation with the leading national and international universities/ institutions in the aviation domain, are being forged towards proffering global knowledge that is customized to local requirements.

RGNAU is a very student friendly place and all efforts are made to ensure that the students are provided the best opportunities that are needed to create outstanding pool of human resources to meet the global challenges in all spheres. The students are required to follow certain procedures and meet specified academic requirements each semester. This comprehensive information on the Rules and Regulations for B.Tech.(Aerospace) programmes are given below.

We urge the students to make best use of the world class infrastructure and facilities available at RGNAU and wish all of them all the very best for a successful career.

## 1.0 Academic Programme: Under-Graduate 4 Years Degree Programme in Bachelor of Technology in Aerospace Engineering:

1.1 Rajiv Gandhi National Aviation University offers a 4-Years (8 semesters) **Bachelor of Technology (B.Tech.) in Aerospace Engineering** degree programme simultaneously under Choice Based Credit System (CBCS). This programme is designed as per UGC guidelines.

1.2 Maximum time to complete **Bachelor of Technology** degree programme by the student is 7 (Seven) years.

## 2.0 Academic Calendar:

2.1 The academic session is divided into two semesters each of approximately 15 weeks' duration: an Autumn Semester (July- December) and a Spring Semester (January-May).

2.2 The Academic Council approved schedule of academic activities for a session, inclusive of dates for registration, mid-semester and end-semester examinations, inter-semester breaks etc., shall be laid down in the Academic Calendar for the session and published on Institute Web Site. The Academic Calendar shall strive to provide for a total of about 90 working days in each semester.

**3.0 Admission:**

3.1 The Candidates who have scored a minimum of 50% marks in aggregate in 10+2 with Physics, Mathematics, and English as compulsory subjects from a recognized board can apply for admission in this Programme. Relaxation of 5% of marks is allowed for candidates belonging to SC/ST category to be eligible for admission.

3.2 Age limit: Not more than 21 years from the last date of admission, and should be able to produce the final mark sheet by 31 August of the year of admission or as prescribed from time to time.

3.3 The selection of the candidates will be based on the Academic Performance in 10+12 followed by written examination (online or offline) and/or Group Discussion & Personal Interview, as decided by the University. The details of weightage of Academic Performance written exams and/ or Group Discussion & Personal interview given below:

| Sl.No. | Exam | Weightage % | Remark |
|---|---|---|---|
| 1. | $10^{th}$ Standard | 15 | |
| 2. | $12^{th}$ Standard | 15 | 30 % |
| 3. | Written Exams:<br>(a) JEE Main Score – 50%<br>(b) CUET & Other Equivalent Exams Score- 40 % | 50 % or<br>40 % | 50 % or<br>40 % |
| 5. | Group Discussion: | 10 % | 10% |
| 6. | Personal Interview:<br>(a) JEE Main candidates<br>(b) CUET & Other Equivalent Exams Candidates | 10 %<br>20 % | 10 % or<br>20% |
| | Total | | 100 % |

**Note: The decision of the University to fix above criteria and any amendment shall be final and binding on all.**

3.4 University may change admission rules at the time of admission by issue of detailed admission notice on the recommendation of Academic Council.

3.5 General Rule relating to the admission as per Rajiv Gandhi National Aviation University Ordinance, 2020. Chapter XII (Part-I) shall be applicable. Ordinance is available on University Web-site (www.rgnau.ac.in) .

**4.0 B. Tech. Programme structure:**

4.1 A student after securing admission shall complete the B.Tech. Programme in the respective discipline in a minimum period of **Four** academic years (8 semesters), and a maximum period of **Seven** academic years (14 Semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech. Programme in the respective discipline. Each student shall secure **178 credit**s (with CGPA ≥ 5) required for the completion of the Bachelor of Technology programme and award of the B.Tech. degree in the respective discipline.

**4.2 Semester scheme:**

Each undergraduate programme is of 4 academic years 8 semesters) with the academic year divided into two semesters of 15 weeks (≥ 90 instructional days) each, each semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/Programme structure as suggested by University are followed.

4.3 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms.

**4.4 Credit Programmes**

All Subject/ Courses are to be registered by the student in a semester to earn credits which shall be assigned to each Subjects/ Courses in an L: T: P: C (Lecture periods: Tutorial periods: Practical periods: Credits) structure based on the following general pattern.

- One credit for one hour/ week for theory/ lecture (L) period or Tutorials (T) period.
- One Credits for two hours/ week for laboratory/ practical (P) periods.

**4.5 Programme Curricula:** Programme Structure and Syllabi is attached as **Annexure-1.**

**5.0 Attendance requirements:**

5.1 A student admitted to a Programme of study shall maintain a minimum attendance of seventy-five per cent in a semester in all his subjects/ courses during the Programme of study.

5.2 The student who fails to achieve the seventy-five per cent (75%) attendance shall not be permitted to sit for the Semester End Examination in the respective subject/ course and

shall have to repeat the subject/ course.

5.3 Any student who failed to achieve the seventy-five per cent. attendance in a subject/ course more than twice during the Programme of study, the student shall be detained and such students shall have to seek fresh admission and be required to go through the entire admission process again.

5.4 The teacher handling a subject / course shall maintain a record of attendance of students who have registered for the subject / course and shall display on the notice board of the Department the monthly attendance record of each student.

5.5 The teachers shall intimate the Head of Department concerned, at least seven calendar days before the last instruction day in the semester, particulars of all students who have secured less than seventy-five per cent. attendance in their respective subject/ courses, thereafter, the Head of Department shall display on the notice board of the Department, names of all students who shall not be eligible to take the semester-end examinations in the various subject/ courses and send a copy of the same to the Dean of the School concerned.

5.6 The Dean of the School concerned may grant exemption to a candidate who has failed to obtain the minimum prescribed seventy-five per cent. attendance for valid reasons provided that such exemption shall not be granted for attendance below sixty-five per cent.

## 6.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in Item No.**5.**

6.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, , if student secures not less than 35% (14 marks out of 40 marks) in the internal examinations, not less than 35% (21 marks out of 60 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

6.2 A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

6.3 A student has to undergo Internship/Project in the last (Eighth Semester) in the Aviation Industry or related Industry. A Student has to opt for one of the faculty as internal project guide from University Department and one Industry guide from concerned Industry to be opt external project guide at the beginning of Internship/Project with approved synopsis for the Internship/Project. A student has to submit his/her detailed Internship/Project report on completion of Internship/Project for evaluation and he/she has to give presentation to the Evaluation committee constituted by HOD of the University.

6.4 A student (i) shall register for all subject/ courses covering 178 credits as specified and listed in the Programme structure, (ii) fulfills all the attendance and academic requirements for 178 credits, (iii) earn all 178 credits by securing SGPA ≥ 5.0 (in each semester), and CGPA (at the end of each successive semester) ≥ 5.0, (iv) passes all the mandatory Programmes, to successfully complete the under graduate programme. The performance of the student in these 178 credits shall be considered for the calculation of the final CGPA (at the end of under graduate programme) .

6.6 A student eligible to appear in the semester end examination for any subject/ course/ Programme, but absent from it or failed (thereby failing to secure 'C' grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ cour will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject/ course.

6.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been readmitted shall be applicable. However, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has been detained.

**7.0 Evaluation - Distribution and Weightage of marks**

7.1 The performance of a student in every subject/ coursewill be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

7.2 In CIE, for theory subject/ courses, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

Mid-Term Examination for 30 marks:

Part - A: Objective/quiz paper for 10 marks.

Part – B: Descriptive paper for 20 marks. (4 questions out of 6 questions) The remaining 10 marks are for Continuous Internal Assessment (out of 40 marks) andare distributed as:

7.3 Assignment for 5 marks. (Average of 2 Assignments each for 5 marks)

7.4 PPT presentation/ group discussion/ role plays/ best practices in an organizationCase study (or) Survey (or) Team based presentations on a topic in the concerned subject/ course for 5 marks before II Mid-Term Examination.

7.5 The objective/quiz paper is set with multiple choice, fill-in the blanks and matchingtype of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.The average of two Mid-Term examinations is considered for 30 marks.

7.6 While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

7.7 Five (5) marks are allocated for assignments (as specified by the subject/ course teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shallbe taken as the final marks for assignment (for 5 marks).

7.8 The student, in each subject/ course, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

*7.9 The student is eligible to write Semester End Examination of the concerned subject/ course, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks. In case, the student appears for Semester End Examination (SEE) of the concerned subject/ course but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks),his performance in that subject/ course in SEE shall stand cancelled in-spite of appearing the SEE.*

7.10 There is NO Computer Based Test (CBT) for R22 regulations.

**7.11 A candidate shall be given only one-time chance to re-register and attend the classes for a maximum of two subject/ courses in a semester:**

a) If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject/ course Viva- voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject/ course) areless than 35% and failed in those subject/ courses.

b) A student must re-register for the failed subject/ course(s) for 40 marks within four weeks of commencement of the classwork in next academic year.

c) In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

**8.0 Grading procedure:**

**8.1** Grades will be awarded to indicate the performance of students in each theory subject/ course, laboratory / practical/ Industry Oriented Mini Project/Internship and project. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 7 above, a corresponding letter grade shall be given.

**8.2** As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

| % of Marks Secured in a Subject/ course (Class Intervals) | Letter Grade (UGC Guidelines) | Grade Points |
|---|---|---|
| Greater than or equal to 90% | O (Outstanding) | 10 |
| 80 and less than 90% | A+ (Excellent) | 9 |
| 70 and less than 80% | A (Very Good) | 8 |
| 60 and less than 70% | B+ (Good) | 7 |
| 50 and less than 60% | B (Average) | 6 |
| 40 and less than 50% | C (Pass) | 5 |
| Below 40% | F (Fail) | 0 |
| Absent | Ab | 0 |

**8.3** A student who has obtained an '**F'** grade in any subject/ course shall be deemed to have '**failed'**and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subject/ courses will remain the same as those obtained earlier.

**8.4** To a student who has not appeared for an examination in any subject/ course, '**Ab'** grade will be allocated in that subject/ course, and he is deemed to have '**Failed'**. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subject/ courses will remainthe same as those obtained earlier.

**8.5** A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

**8.6** A student earns Grade Point (GP) in each subject/ course/ Programme, on the basis of the letter gradesecured in that subject/ course/ Programme. The corresponding 'Credit Points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course/ Programme.

**Credit Points (CP) = Grade Point (GP) x Credits …. For a Programme**

**8.7** A student passes the subject/ course only when GP ≥ 5.0 ('C' grade or above)

**8.8** The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (CP) secured from all subject/ courses/ Programmes registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$SGPA = \frac{\sum_{i=1}^{n} c_i g_i}{\sum_{i=1}^{n} c_i}$$

where 'i' is the subject/ course indicator index (considering all subject/ courses in a semester), 'N' is the no. of subject/ courses 'registered' for the semester (as specifically required and listed under the Programme structure of the parent department), Ci is the no. of credits allotted to the ith subject/ course, and Gi represents the grade points (GP) corresponding to the letter grade awarded for that ith subject/ course.

**8.9** The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in all registered courses (of 178) in all semesters, and the total number of credits registered in all the semesters. CGPA is rounded off to two decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula (i.e., up to and inclusive of S semesters, S ≥ 2),

$$CGPA = \frac{\sum_{i=1}^{m} c_i g_i}{\sum_{i=1}^{m} c_i}$$

where 'M' is the total no. of subject/ courses (as specifically required and listed under the Programme structure of the parent department) the student has 'registered' i.e., from the 1st semester onwards up to and inclusive of the 6th semester, 'j' is the subject/ course indicator index (takes into account all subject/ courses from 1 to 6 semesters), Cj is the no. of credits allotted to the jth subject/ course, and Gj represents the grade points (GP) corresponding to the letter grade awarded for that $j^{th}$ subject/ course. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

**8.10** For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.

**8.11** SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subject/ courses of that semester are passed in first attempt. Otherwise, the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory Programmes will not be taken into consideration.

## 9.0 Passing standards

9.1 A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 ('C' grade or above) in every subject/ course in that semester (i.e. when the student gets an SGPA ≥ 5.00 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire under graduate programme, only when gets a CGPA ≥ 5.00 ('C' grade or above) for the award of the degree as required.

9.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the Programmes registered (Programme code, title, no. of credits, grade earned, etc.) and credits earned. **There is NO exemption of credits in any case.**

## 10.0 Declaration of results:

10.1 Computation of SGPA and CGPA are done using the procedure listed in 8.1 to 8.11.

10.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

$$\% \text{ of Marks} = (\text{final CGPA} - 0.5) \times 10$$

**11.0 Award of degree**

11.1 A student who registers for all the specified subject/ courses as listed in the Programme structure and secures the required number of 178 credits (with CGPA ≥ 5.0), within 4 academic years from the date of commencement of the first academic year, shall be declared to have 'qualified' for the award of Bachelor of Technology in Aerospace Engineering, selected at the time of admission.

11.2 A student who qualifies for the award of the degree as listed in item 10.1 shall be placed in the following classes.

11.3 A student with final CGPA (at the end of the under graduate programme) > 8.00, and fulfilling the following conditions - shall be placed in 'First Class with Distinction'.

However, he

a) Should have passed all the subject/ courses/Programmes in 'First Appearance' within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

b) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

c) A student not fulfilling any of the above conditions with final CGPA > 8 shall be placed in 'First Class'.

11.4 Students with final CGPA (at the end of the under graduate programme) ≥ 7.00 but <8.00 shall be placed in 'First Class'.

11.5 Students with final CGPA (at the end of the under graduate programme) ≥ 6.0 but < 7.0, shall be placed in 'Second Class'.

11.6 All other students who qualify for the award of the degree (as per item 10.1), with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 6.0, shall be placed in 'Pass Class'.

11.7 A student with final CGPA (at the end of the under graduate programme) < 5.00 will not be eligible for the award of the degree.

11.8 University also offer following Degree /Certificate under the UGC Curriculum & Credit

Framework for undergraduate programme of B.Tech.(Aerospace) :

(a) A UG certificate after completing 1 year (2 semesters) of study and secured grade point-5 for Semester-1 & 2, if, in addition, they complete one vocational Programme of 4 credits during the summer vacation of the first year.

(b) A UG diploma after 2 years (4 semesters) of study and secured grade point-5 for Semester-1 to 4, if, in addition, they complete one vocational Programme of 4 credits during the summer vacation of the first year.

## 12.0 Supplementary Examination

12.1 A student will be eligible to appear in the supplementary examination in a subject/ course if he/she actually appeared at the last end-semester examination in that subject/ course and obtained the grade 'F'.

12.2 However, if a student has been absent in the End Semester examination (a) due to medical reasons, that are duly certified by RGNAU Doctors or (b) due to a calamity in the family his/her case will be considered for supplementary with full credit. In such cases the student must apply in writing to the Dean (Academic) through the concerned Teacher/Head of the Department.

12.3 All medical cases will be put up for consideration to the medical board. Only upon certification by the medical board the student will be granted full credit.

12.4 A student will not be allowed to appear in more than 5 (five) subject/ courses in the supplementary examinations.

12.5 Intending students must submit their application, countersigned by the teacher(s) of the subject/ course(s) or the Head of the Department concerned, along with the necessary fees to the Academic Section by the date as announced by a notification.

12.6 The supplementary examinations shall be held on such dates as laid down in the Academic Calendar for the year or as notified separately.

12.7 The grade in the subject/ course scored by the student appearing in the supplementary examination will be recomputed by substituting the marks of the end-semester in the total marks scored by that scored in the supplementary examination. Unless granted full credit by virtue of Section 12.2 12.3 above, a student is entitled only to one grade lower than the actual grade thus scored, except that the performance grade 'C' remains unaltered, as elucidated in the table below:

Table

| **Grade Obtained** | **Grade to be Awarded** |
|---|---|
| Ab | Ab |
| F | F |
| C | C |

| | |
|---|---|
| B | C |
| B+ | B |
| A | B+ |
| A+ | A |
| O | A+ |

12.8 However, if a student misses the end-semester examination due to a compelling reason like serious illness of himself/herself or a calamity in the family, he/she may appeal to the Dean, through his/her Head of the Department for permitting himself/herself to appear at the supplementary examination. A sub-committee may, after examining the documents and being convinced about the merit of the case, recommend permitting him/her to appear in the supplementary examination(s) with full credit condoning his/her absence.

12.9 With the concurrence of the Faculty Adviser a student may be allowed to change his/her registration of subject/ courses within one week from the day of registration.

12.10 Students will be permitted to appear in the examinations in only those subject/ courses for which they have registered at the beginning of the semester and have not been debarred.

**13.0 Grade Revision**

13.1 A letter grade once awarded shall not be changed unless the request made upon detection of genuine error of omission and/or commission by the concerned teachers/coordinators with all relevant records and justification and recommended by the departmental Academic committee and Head of the Department and approved by the Chairperson, Academic Council within a maximum period of 7 (seven) days from the assigned date(s) of the registration of the next semester due date as provided in the Academic Calendar.

13.2 No change will be permitted for re-examination and supplementary examination grades. However, in an extraordinary circumstance, the grade change will be allowed only after approval of the Chairperson, Academic Council within a maximum period of 1 (one) day after the Internal Academic Committee meeting considering the re-examination and supplementary results.

13.3 Students who have obtained CGPA lower than 5.00 may be allowed, on the recommendation of the Head of the Department and the approval of the Dean (Academic), to re-register in one or more subject/ courses in which he/she received ‘C’ grade(s), so as to improve his/her CGPA to 5.00 or above, provided that the subject/ course(s) is/are otherwise being offered in that semester and there is no clash in the time table. The grade will be revised and recorded only if there is an improvement.

13.4 Appearing in the end-semester examination in the theory component of a subject/ course is compulsory for a student, unless exempted as per rule. If a student fails to appear in the end-semester examination he/she will be assigned an ‘F’ grade in the subject/ course and will not be permitted to appear at the supplementary examination for the subject/ course.

## 14.0 Withdrawal from the University

14.1 A student who has been admitted to a undergraduate degree program of the University may be permitted to withdraw temporarily for a period of one semester or more from the University on grounds of prolonged illness or acute problem in the family which compelled him/her to stay at home, Provided

a) He/she applies to the University within 15 days of the commencement of the semester or from the date he/she last attended his/her classes whichever is later, stating fully the reasons for such withdrawal together with supporting documents and endorsement of the father/guardian.

b) The University is satisfied that, inclusive of the period of withdrawal, the student is likely to complete his requirements for the degree within the time limits to be specified in regulation.

c) There is no outstanding dues or demands from him/her by the University/Hostel/Department/ Library etc.

14.2 A student who has been granted temporary withdrawal from the University under the above provisions will be required to pay the tuition fee and other essential fees/charges for the intervening period till such time as his/her name is borne on the Roll of University.

14.3 A student will be granted only one such temporary withdrawal during his/her tenure as a student of the Institute.

14.4 A student who has been granted a temporary withdrawal on medical grounds will be allowed to rejoin and resume his/her studies only after being declared medically fit by the RGNAU Doctors. In specific case, the University may determine that the students may administer a mandatory medical leave on medical ground.

## 15. Striking-off the name from the University Roll List

If a student does not register for 3 (three) consecutive semesters, without the approval of the competent authority his/her name will be struck off from the University Roll List on recommendation by the department.

## 16. Relaxation:

The Academic Council may, under exceptional circumstances, consider any case of a student having a minor deficiency in respect of any of the requirements stated in these Regulations and relax the relevant provision of these Regulations based on the merit of the case. The grounds on which such relaxation is granted shall invariably be recorded and cannot be cited as precedence.

## 17. Withholding of results

If the student has not paid the fees to the University at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student

may be withheld, and the student will not be allowed to promoted the next higher semester. The award or issue of the degree may also be withheld in such cases.

**18. Conduct and Discipline:** Following rules shall be in force to govern the conduct and discipline of all students:

18.1 Students shall show due respect to the teachers of the University, the Wardens of the Hostels, the Sports Officers and other officers/employee of the University.

18.2 Proper courtesy and consideration should be extended to the employees of the University and of the Hostels. They shall also pay due attention and courtesy to visitors.

18.3 Students are required to develop a friendly relationship with fellow students. In particular, they are expected to show kindness and consideration to the new students admitted to the University every year. Law bans ragging in any form to any body - acts of ragging will be considered as gross indiscipline and will be severely dealt with.

18.4 The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures:

a) Ragging
b) Furnishing false statement of any kind in the form of application for admission or for award of scholarship etc.
c) Displaying lack of courtesy and decorum; resorting to indecent behavior anywhere within or outside the campus.
d) Willfully damaging or stealthily removing any property/belongings of the University, Hostel or fellow students.
e) Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
f) Adoption of unfair means in the examinations.
g) Organizing or participating in any group activity in company with others in or outside the campus without prior permission of the Dean
h) Mutilation or unauthorized possession of library books.
i) Resorting to noisy and unseemly behavior, disturbing studies of fellow students.
j) Misuse of Internet/e-mail facilities or tempering/ hacking with servers anywhere in the Hostel/Departments etc.
k) Not intimating his/her absence to the Warden of the Hostel before availing any leave.

18.5 Commensurate with the gravity of the offence, the punishment may be reprimand, fine, expulsion from the Hostel, debarment from an examination, rustication for a specified period or even outright expulsion from the University.

18.6 All cases involving punishment other than reprimand shall be reported to the Chairman of the Standing Disciplinary Committee.

18.7 All major acts of indiscipline, which may have serious repercussion on the general body of students, and/or which may warrant a uniform and more formalized nature of

investigation, shall be handled by the **Standing Disciplinary Committee** appointed by Academic Council.

18.8 Recommendation of the committee, which will include the suggested punishment in cases of guilt proven, will be forwarded to the Chairperson Academic Council for necessary action.

18.9 Cases of adoption of unfair means in an examination shall be dealt with by the **Committee on Prevention of Examination Malpractices.**

18.10 The Committee shall recommend appropriate measures in each case to the Chairperson of the Academic Council for awarding the punishment.

**19. Unfair means:**

Cases of unfair means shall be dealt as per the rules of the University and the Government Public Examination (Prevention of Unfair means) Act if any in force.

**20. Scope :**

20.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

20.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

20.3 The University may change or amend the academic regulations, Programme structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the University authorities.

20.4 Where the words “he”, “him”, “his”, occur in the regulations, they include “she”,“her”, “hers”.

**Annexure-1**

## Programme Structure and Syllabi for B.Tech. (Aerospace Engineering)

| Course/ Subject Code | Subject | L | T | P | Credits |
|---|---|---|---|---|---|
| | **Semster-1** | | | | |
| | PHYSICS | 3 | 1 | 0 | 4 |
| | PHYSICS LAB | 0 | 0 | 3 | 2 |
| | CHEMISTRY | 3 | 1 | 0 | 4 |
| | CHEMISTRY LAB | 0 | 0 | 3 | 2 |
| | ENGINEERING MATHEMATICS-1 | 3 | 1 | 0 | 4 |
| | ENGINEERING MECHANICS - I (STATICS) | 3 | 0 | 2 | 4 |
| | ENGINEERING DRAWING & COMPUTER GRAPHICS | 1 | 0 | 3 | 3 |
| | **Semester Credit Total** | | | | **23** |
| | **Semster-2** | | | | |
| | ENGINEERING MATHEMATICS-2 | 3 | 1 | 0 | 4 |
| | COMPUTER PROGRAMMING & NUMERICAL METHODS | 3 | 0 | 0 | 3 |
| | COMPUTER PROGRAMMING & NUMERICAL METHODS LAB | 1 | 0 | 3 | 3 |
| | ELECTRICAL TECHNOLOGY | 3 | 1 | 0 | 4 |
| | ELECTRICAL TECHNOLOGY LAB. | 0 | 0 | 3 | 2 |
| | INTRODUCTION TO BIOLOGY | 3 | 0 | 0 | 3 |
| | ENGINEERING MECHANICS - II (DYNAMICS) | 3 | 1 | 0 | 4 |
| | **Semester Credit Total** | | | | **23** |
| | **Semster-3** | | | | |
| | FLUID MECHANICS & HEAT TRANSFER | 3 | 1 | 0 | 4 |
| | ENGLISH – I | 2 | 1 | 0 | 3 |
| | BASIC ELECTRONICS | 3 | 1 | 0 | 4 |
| | BASIC ELECTRONICS LAB. | 0 | 0 | 3 | 2 |
| | MATHEMATICS -3 (Half Semester Course) | 3 | 0 | 0 | 1.5 |
| | INTRODUCTION TO AEROSPACE ENGINEERING (Half Semester Course) | 3 | 0 | 0 | 1.5 |
| | SOLID MECHANICS | 3 | 1 | 0 | 4 |
| | MATERIALS AND MANUFACTURING PROCESSES | 3 | 0 | 0 | 3 |
| | **Semester Credit Total** | | | | **23** |
| | **Semster-4** | | | | |
| | ENGLISH – II | 2 | 0 | 1 | 3 |
| | AERODYNAMICS - I | 3 | 1 | 0 | 4 |
| | AERODYNAMICS LAB-I | 0 | 0 | 3 | 2 |
| | HISTORY OF THE MODERN WORLD | 3 | 0 | 0 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| | INTRODUCTION TO AUTOMATIC CONTROL | 3 | 1 | 0 | 4 |
| | AEROSPACE STRUCTURES - I | 3 | 0 | 1 | 4 |
| | STRUCTURES LAB -I | 0 | 0 | 3 | 2 |
| | **Semester Credit Total** | | | | **22** |
| | **Semster-5** | | | | |
| | MECHANICS OF FLIGHT | 3 | 1 | 0 | 4 |
| | AERODYNAMICS - II | 3 | 1 | 0 | 4 |
| | AERODYNAMICS LAB-II | 0 | 0 | 3 | 2 |
| | AEROSPACE STRUCTURES - II | 3 | 1 | 0 | 4 |
| | STRUCTURES LAB -II | 0 | 0 | 3 | 2 |
| | AEROSPACE PROPULSION | 3 | 1 | 0 | 4 |
| | PROPULSION LABORATORY | 0 | 0 | 3 | 2 |
| | **Semester Credit Total** | | | | **22** |
| | **Semster-6** | | | | |
| | AIRCRAFT STABILITY AND CONTROL | 3 | 1 | 0 | 4 |
| | MECHANICAL VIBRATIONS | 3 | 1 | 0 | 4 |
| | AVIONICS | 3 | 1 | 0 | 4 |
| | SPACE MECHANICS | 3 | 0 | 0 | 3 |
| | INTRODUCTION TO MACRO- AND MICRO-ECONOMICS | 3 | 0 | 0 | 3 |
| | NUMERICAL METHODS IN AEROSPACE ENGINEERING | 3 | 0 | 0 | 3 |
| | NUMERICAL METHODS LAB | 0 | 0 | 3 | 2 |
| | **Semester Credit Total** | | | | **23** |
| | **Semster-7** | | | | |
| | PRINCIPLES OF AIRCRAFT DESIGN | 1 | 0 | 3 | 3 |
| | SUMMER TRAINING/INTERNSHIP | 0 | 0 | 0 | 2 |
| | AIRCRAFT MAINTENANCE – I | 3 | 0 | 0 | 3 |
| | AIRCRAFT MAINTENANCE WORKSHOP - I | 0 | 0 | 3 | 2 |
| | ELECTIVE I | 3 | 0 | 0 | 3 |
| | ELECTIVE II | 3 | 0 | 0 | 3 |
| | INTRODUCTION TO THE PRINCIPLES OF MANAGEMENT | 3 | 0 | 0 | 3 |
| | ELECTIVE III | 3 | 0 | 0 | 3 |
| | **Semester Credit Total** | | | | **22** |
| | **Semster-8** | | | | |
| | COMPREHENSIVE VIVA VOCE | 0 | 0 | 0 | 2 |
| | ELECTIVE IV | 3 | 0 | 0 | 3 |
| | ELECTIVE V | 3 | 0 | 0 | 3 |
| | AIRCRAFT MAINTENANCE – II | 3 | 0 | 0 | 3 |
| | AIRCRAFT MAINTENANCE WORKSHOP - II | 0 | 0 | 3 | 2 |
| | AVIATION MANAGEMENT | 3 | 0 | 0 | 3 |
| | PROJECT | 0 | 0 | 0 | 4 |
| | **Semester Credit Total** | | | | **20** |

**Summary of Credits**

| Semester | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Total |
|---|---|---|---|---|---|---|---|---|---|
| Credit | 23 | 23 | 23 | 22 | 22 | 23 | 22 | 20 | 178 |

**Electives: (all electives are of 3-0-0 contact hours and 3 credits)**

| Course/ Subject Code | A: Aerodynamics | |
|---|---|---|
| | Computational Fluid Dynamics | Elective I or II |
| | Advanced computational fluid dynamics (prerequisite: 1) | Elective IV or V |
| | Industrial Aerodynamics | Any |
| | Theory of viscous flows | Any |
| | **B: Aircraft Structures** | |
| | Finite element method | Elective I or II |
| | Advanced finite element method (prerequisite: 1) | Elective IV or V |
| | Composite structures | Any |
| | Fracture Mechanics | Any |
| | Vibration instrumentation & control | Any |
| | Aeroelasticity | Any |
| | **C: Aircraft propulsion** | |
| | Rocket propulsion | Any |
| | New propulsion systems | Any |
| | Principles of combustion and emission | Any |
| | **D: Flight mechanics & automatic control** | |
| | Automatic control of aircraft | Any |
| | Drone and unmanned aircraft technology | Any |
| | Helicopter engineering | Any |
| | Flight Laboratory (in collaboration with IIT Kanpur) | Any |
| | **E: Humanities & social sciences** | |
| | Values & Ethics | Any |
| | Economics of airlines operations | Any |
| | Introduction to Psychology | Any |
| | **F: Miscellaneous topics** | |
| | Soft computing, Artificial Intelligence & Machine Learning | Any |

| Subject Code: | | Course Title : Physics |
|---|---|---|
| Contact Hours | Lecture- 3 Tutorial-0 Practical-0 Credit-3 | |
| Objectives | The aim of the Physics curriculum for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of fundamental physical principles. This knowledge is essential for the application of these concepts in various aerospace engineering contexts. | |

**Content**

Wave Motion and physical optics:

The wave equation, plane waves, phase velocity, superposition, wave packets and group velocity, dispersion relations. Electromagnetic waves, reflection and refraction, Stokes' relations in optics. Superposition of waves, interference, coherence, diffraction, polarisation, birefringence. Lasers.

Thermodynamics

Thermodynamic systems: properties, states, processes; point and path functions. Thermal equilibrium, the zeroth law thermodynamics, temperature; measurement of temperature. Heat and heat transfer: modes of heat transfer, conduction, convection, and radiation.

The pure substance and the equilibrium of its phases; the ideal gas equation of state, the universal gas constant; real gases, the compressibility factor.

Work: displacement work at a system boundary; work in ideal gas systems undergoing isobaric, isochoric, and isothermal processes; work in free expansion of a gas.

Equivalence of work and heat, Joule's experiment; the first law of thermodynamics for cyclic and non-cyclic processes, internal energy. Generalization of energy of a system to include macroscopic forms like kinetic and potential energies; generalized first law of thermodynamics; enthalpy; specific heats of gases at constant volume and constant pressure; specific heats of ideal gases. The reversible adiabatic process, polytropic processes; application of first law to some closed systems.

Limitations of the first law; the second law of thermodynamics; Clausius and Kelvin-Planck statements of the second law and their equivalence. Reversible and irreversible processes and their characteristics, internal and external reversibilities. Reversible cycles, the Carnot cycle and the reversed Carnot cycle – major deductions vis-à-vis the reversible engines – thermodynamic temperature scale – perpetual motion machines.

Entropy and its relevance to spontaneous and irreversible processes; entropy is a property; calculation of entropy changes: calculation of entropy changes from the Tds equations; the canonical equations of state, E=E(S, V) and H=H(S, p), the Mollier diagram – principle of increase of entropy.

| **Subject Code:** | | **Course Title : Physics Laboratory** |
|---|---|---|
| **Contact Hours** | **Lecture- 0** | **Tutorial-0** **Practical-3** **Credit-2** |
| **Objectives** | The aim of the laboratory work for the Physics course tailored for B.Tech. students specializing in Aerospace is to enhance practical understanding of theoretical concepts. This hands-on experience is designed to bridge the gap between classroom learning and real-world applications in the field of aerospace engineering. | |
| **Content** | | |
| 1. Newton's Rings: To study the interference fringes of equal thickness to determine the wave length of Sodium light.<br>2. Michelson Interferometer: To study the interference fringes of equal inclination and to determine the wavelength of He-Ne laser light.<br>3. Single Slit Diffraction: To study the single slit Fraunhofer diffraction and to plot the intensity distribution of the diffraction pattern by a slit.<br>4. Diffraction Grating: To study the multi-slit Fraunhofer diffraction and to determinethe wavelengths of the spectral lines of mercury.<br>5. Prism Spectrometer: To study the prism dispersion and to plot refractive index vs. wavelength curve.<br>6. Polarimeter: To study polarised light and to determine the specific rotation of anoptically active substance by a polarimeter. | | |

| Subject Code: | | Course Title : Chemistry |
|---|---|---|
| Contact Hours | Lecture- 3 Tutorial-0 Practical-0 Credit-3 | |
| Objectives | The objective of the Chemistry course for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the fundamental principles of chemistry and their applications in the aerospace industry. This course aims to equip students with the necessary knowledge to analyze materials and chemical processes relevant to aerospace engineering. | |

**Content**

Module 1 Physical Chemistry Principles of Thermodynamics: First and Second Law of Thermodynamics, Concept of Entropy, Helmholtz and Gibbs free energy, Equilibrium and spontaneity conditions for Closed Systems, Maxwell Relations, The Chemical Potential; Definition and Concept of Open Systems. Applications: Phase equilibria, Reaction Equilibria, Electrochemical Equilibrium, Application of thermodynamics to real world Problems. Module 2 Inorganic Chemistry Bonding and Coordination Chemistry: Bonding in homo (Li2 to N2, O2 and F2) and hetero (CO only) dinuclear systems. CFT and its applications. Metal ions from laboratory to living systems: Spectroscopic, magnetic, functional properties of new age coordination compounds and Hemoglobin. Organometallics and Catalysis: Metal carbonyls. Oxidative addition and reductive elimination, insertion and elimination reactions. Hydrogenation (Wilkinson's catalyst) and Carbonylation (Monsanto process). Redox Chemistry: Diagrammatic representation and use of Latimer and Frost diagrams. Applications of redox chemistry in energy storage (primary and secondary batteries). Materials Chemistry: Metal oxides, spinels, superconductors, and boron nitride. Module 3 Organic Chemistry Understanding the 3-D Structure of Organic Compounds: Concept of chirality and molecular structure (basic symmetry elements Sigma -plane and inversion centre); Representations in 2D and 3D forms; Absolute configuration and CIP nomenclature (case studies); Molecules devoid of point chirality (allenes and biphenyls, brief discussion); Significance of chirality in living systems (brief discussion) Conformational analysis (definition and implication); Dihedral angle, torsional angle and strain); Few acyclic systems (Gauche butane interactions); Few monocyclic systems and its conformational aspects (Cyclopropane to Cyclohexanes) Initial Strategies towards the Synthesis of New Chemical Entities: Nucleophilic Substitution reaction at saturated carbon (SN2/SN1 and SNi reaction; definitely brief SNi and NGP in detail), Stereochemical implication of SN reactions Elimination reaction: Syn 1,2 elimination reactions (Cope and related reactions with examples)

| **Subject Code:** | | **Course Title : Chemistry Laboratory** |
|---|---|---|
| **Contact Hours** | **Lecture- 0** | **Tutorial-0** **Practical-3** **Credit-2** |
| **Objectives** | The aim of the laboratory work for the Chemistry course tailored for B.Tech. students specializing in Aerospace is to enhance practical understanding of chemical principles. This hands-on experience is designed to complement theoretical knowledge, fostering a deeper comprehension of the subject matter. | |
| **Content** | | |
| Physical Chemistry (Any 4 from the list given below) 1. Determination of heat of neutralization of acid by base 2. Conductometric titration 3. Chemical Kinetics 4. Effect of surfactants on the surface tension of water 5. Solubility of a sparingly soluble salt in water 6. pH metric titration Inorganic Chemistry (Any 4 from the list given below) 1. Spectrophotometric determination of acid dissociation constant of methyl red an acid base indicator 2. Potentiometric titration of a given sodium carbonate solution with aqueous hydrochloric acid solution 3. Determination of sodium (Na ) and potassium ion (K ) concentrations in any mineral or drinking water sample 4. Estimation of sulphate ion in Tap Water by Nepheloturbidimetric analysis 5. Estimation of iodine content in iodized salt by iodometric redox titration 6. Experimental verification of crystal field theory (CFT) and the spectrochemical series using cobalt(III) complexes Organic Chemistry (ALL 4 from the list given below) 1. Analysis of unknown organic solid sample 2. Analysis of unknown organic liquid sample 3. Synthesis of benzoic acid using household bleach 4. Reaction rate comparison for nucleophilic substitution reaction of organic halides. | | |

| **Subject Code:** | | **Course Title : Mathematics-I** |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** **Practical-0** **Credit-3** |
| **Objectives** | The objective of the Mathematics curriculum for B.Tech. students specializing in Aerospace Engineering is to equip them with essential mathematical skills and concepts. This foundation is crucial for understanding complex engineering principles and solving real-world problems encountered in the aerospace field. | |
| **Content** | | |
| Differential Calculus (Functions of one Variable): Rolle s theorem, Cauchy s mean value theorem (Lagrange s mean value theorem as a special case), Taylor s and Maclaurin s theorems with remainders, indeterminate forms, concavity and convexity of a curve, points of inflexion, asymptotes and curvature. Differential Calculus (Functions of several variables): Limit, continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation, differentials, derivatives of composite and implicit functions, derivatives of higher order and their commutativity, Euler s theorem on homogeneous functions, harmonic functions, Taylor s expansion of functions of several variables, maxima and minima of functions of several variables - Lagrange s method of multipliers. Ordinary Differential Equations: First order differential equations - exact, linear and Bernoulli s form, second order differential equations with constant coefficients, method of variation of parameters, general linear differential equations with constant coefficients, Euler s equations, system of differential equations. Sequences and Series : Sequences and their limits, convergence of series, comparison test, Ratio test, Root test, Absolute and conditional convergence, alternating series, Power series. Complex Variables: Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy s integral theorem, independence of path, existence of indefinite integral, Cauchy s integral formula, derivatives of analytic functions, Taylor s series, Laurent s series, Zeros and singularities, Residue theorem, evaluation of real integrals | | |

| **Subject Code:** | | **Course Title :** ENGINEERING MECHANICS - I (STATICS) |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-0** **Practical-0** **Credit-3** | |
| **Objectives** | The aim of the course in Engineering Mechanics for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the fundamental principles governing the behavior of physical systems. This subject is designed to equip students with the analytical skills necessary to solve complex engineering problems related to forces, motion, and equilibrium. | |
| **Content** | | |
| Scalar and vector quantities, axis systems, representation of vectors, vector algebra. Force systems : Moment of a force about a point and about an axis; couple moment; reduction of a force system to a force and a couple. Equilibrium : Free body diagrams; equations of equilibrium of particles and rigid bodies in two and three dimensions; problems involving equilibrium; plane and space frames and trusses. Friction : Laws of Coulomb friction., problems involving static and kinetic friction; power transmission via belt drives. Centroid and moments of area. Introduction to the method of virtual work. | | |

| **Subject Code:** | **B.Tech/Aero/7** | **Course Title :** ENGINEERING DRAWING & COMPUTER GRAPHICS |
|---|---|---|
| **Contact Hours** | **Lecture- 1** **Tutorial-0** **Practical-3** **Credit-3** | |
| **Objectives** | The aim of the course ENGINEERING DRAWING & COMPUTER GRAPHICS is to equip B.Tech. (Aerospace) students with essential skills in technical drawing and digital visualization. This subject focuses on developing proficiency in creating and interpreting engineering drawings, as well as utilizing computer graphics software to enhance design capabilities. | |
| **Content** | | |
| Introduction to IS code of drawing; Conics and Engineering Curves – ellipse, parabola, hyperbola, cycloid, trochoid, involute; Projection of lines – traces, true length; Projection of lines, planes and solids (cube, prism, pyramid, cylinder, cone and sphere);Projection on auxiliary planes; intersection of solids. Isometric projection, isometric scale; Sectioning of solids, true shape of a section. Introduction to CAD tools; development and intersection of surfaces and solids using CAD. | | |

| **Subject Code:** | | **Course Title :** ENGINEERING MATHEMATICS-2 |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The objective of the Mathematics curriculum for B.Tech. students specializing in Aerospace Engineering is to equip them with essential mathematical skills and concepts. This foundation is crucial for understanding complex engineering principles and solving real-world problems encountered in the aerospace field. | |
| **Content** | | |
| Linear Algebra: Algebra of matrices. Vector spaces - linear dependence of vectors, basis, linear transformations, rank and inverse of a matrix, solution of algebraic equations - consistency conditions, Hermitian, skew Hermitian and unitary matrices, bilinear forms, eigenvalues and eigenvectors. Numerical solution of system of linear equations â Gauss, Gauss-Jordan elimination and Gauss-Seidel iteration methods. Integral Calculus: Fundamental theorem of integral calculus, mean value theorems, evaluation of definite integrals - reduction formulae. Convergence of improper integrals, tests of convergence, Beta and Gamma functions - elementary properties. Differentiation under integral sign, differentiation of integrals with variable limits - Leibnitz rule. Rectification, double and triple integrals, computations of area, surfaces and volumes, change of variables in double integrals - Jacobians of transformations, integrals dependent on parameters - applications. Vector Calculus: Scalar and vector fields, level surfaces, directional derivative, Gradient, Curl, Divergence, Laplacian, line and surface integrals, theorems of Green, Gauss and Stokes, line integrals independent of path. Numerical Analysis: Finite differences, Newtons forward and backward interpolation formulae, central difference interpolation formulae. Trapezoidal and Simpsons 1/3rd rules for numerical integration. Solution of polynomial and transcendental equations - bisection, Newton-Raphson and regula-falsi methods. | | |

| | | |
|---|---|---|
| **Subject Code:** | | **Course Title :** COMPUTER PROGRAMMING & NUMERICAL METHODS |
| **Contact Hours** | **Lecture- 3** **Tutorial-0** **Practical-0** **Credit-3** | |
| **Objectives** | The aim of the course in Computer Programming and Numerical Methods for B.Tech. students specializing in Aerospace is to equip them with essential programming skills and numerical techniques. This foundation will enable students to effectively solve complex engineering problems and enhance their computational abilities. | |
| **Content** | | |
| The binary number system and binary arithmetic. Components and operation of a digital computer, internal representation of integer and floating point numbers. Outline of steps to produce executable code from a high level language. The FORTRAN programming language: data types, constants and variables, expressions and assignment statements, input and output statements, file read and write; conditional and branching statements *(solution of non-linear and transcendental algebraic equations)*, iteration statements, 1-d arrays (*sorting & searching*), 2-d arrays (*matrix multiplication, solution of a system of linear algebraic equations by Gaussian elimination, matrix inversion);* subroutines and parameter passing. Strengths and limitations of FORTRAN as a programming language. | | |

| **Subject Code:** | | **Course Title :** COMPUTER PROGRAMMING & NUMERICAL METHODS LAB |
|---|---|---|
| **Contact Hours** | **Lecture- 1** **Tutorial-0** **Practical-3** **Credit-3** | |
| **Objectives** | The aim of the laboratory work in the field of Computer Programming and Numerical Methods is to enhance the practical skills of B.Tech. Aerospace students. This experience is designed to bridge theoretical knowledge with real-world applications, fostering a deeper understanding of programming concepts and numerical techniques. | |

**Content**

1. Familiarization with the FORTRAN programming language
2. Writing and executing programs to illustrate data types, constants, and variables, assignment statements and simple input-output.
3. Writing and executing programs to implement a) the solution of non-linear and transcendental algebraic equations, b) sorting and searching, c) matrix algebra, d) the solution of simultaneous linear algebraic equations, e) matrix inversion. Students should be encouraged to structure their programs using subroutines and functions wherever applicable.

| **Subject Code:** | | **Course Title :** ELECTRICAL TECHNOLOGY |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-1** **Practical-0** **Credit-4** |
| **Objectives** | The aim of the course in Electrical Technology for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of electrical systems and their applications within the aerospace industry. This curriculum is designed to equip students with the necessary theoretical knowledge and practical skills to effectively analyze and design electrical circuits and systems relevant to aerospace engineering. | |
| **Content** | | |
| Basics of electric and magnetic fields. Direct and alternating current. D.c. and a.c electrical circuits: Thevenin and Norton equivalent circuits; Wheatstone bridge. Three-phase a.c. circuits.<br>D.c. motors and generators.<br>Transformers. Rotating magnetic field. A.c. motors and alternators. | | |

Text Book: https://nptel.ac.in/courses/108/105/108105053/ Electrical Engineering Fundamentals by Vincent Del Toro Prentice Hall of India available on Amazon Second Edition printed in 2015 by Pearson

| **Subject Code:** | | **Course Title** : ELECTRICAL TECHNOLOGY LAB |
|---|---|---|
| **Contact Hours** | **Lecture- 1** **Tutorial-0** **Practical-3** **Credit-3** | |
| **Objectives** | The aim of the laboratory work in the field of Electrical Technology for B.Tech. students specializing in Aerospace is to provide practical experience and enhance theoretical knowledge. This hands-on approach is designed to deepen understanding of electrical principles and their applications within the aerospace sector. | |
| **Content** | | |
| 1.To measure the armature and field resistance of a DC machine.<br>2. To calibrate a test (moving iron) ammeter and a (dynamometer) Wattmeter with respect to standard (DC PMMC) ammeter and voltmeters.<br>3. Verification of circuit theorems – Thevenin's and superposition theorems (with DC sources only).<br>4. Measurement of current, voltage and power in R-L-C series circuit excited by single phase) AC supply.<br>5. Open circuit and short circuit tests on a single phase transformer.<br>6. Connection and starting of a three phase induction motor using direct on line (DOL) or star – delta starter.<br>7. Connection and measurement of power consumption of a fluorescent lamp and voltage – current characteristics of incandescent lamps.<br>8. Determination of open circuit characteristics (OCC) of a DC generator.<br>9. Two wattmeter method of measuring power in three phase circuit (resistive load only) | | |

| Subject Code: | | Course Title : INTRODUCTION TO BIOLOGY |
|---|---|---|
| Contact Hours | Lecture- 3 Tutorial-0 Practical-0 Credit-3 | |
| Objectives | The aim of the course INTRODUCTION TO BIOLOGY for B.Tech. (Aerospace) students is to provide a foundational understanding of biological principles and concepts relevant to the field of aerospace engineering. This curriculum is designed to enhance students' comprehension of biological systems and their applications in technology and engineering. | |
| **Content** | | |
| Cellular Biology (10 Lectures)Ultra structure of bacteria, plants and animal cells; cell division, cell cycle and apoptosis; ATP synthesis and Glycolysis; Respiration and photosynthesis.Unit 2:Chemical Biology (10 Lectures)Proteins: structure and sequencing; Enzymes: mechanism, kinetics and inhibition; DNA: structure and sequence, replication, recombination; RNA synthesis; Genetic code and protein biosynthesis; Recombinant DNA technology.Unit 3:Bio-Thermo-Fluidics and Transport Processes (8 Lectures)Noncovalent interactions and free energy changes in biological processes; Fundamentals of momentum, heat and mass transport as applied to biological systems; Human body as a thermodynamic system; Blood Rheology, Fluid mechanical aspects of some diseases and organs; Bio-Micro devices.Unit 4:Impact of Biology on Society and Mankind (2 Lectures)Crop management, Disease control, Biological Hazards and safety; Unsolved Problems in Biology | | |

Suggested Books:

1. Lehninger Principles of Biochemistry, Nelson and Cox,
2. Biochemistry by Berg, Tymoczko and Stryer
3. Biochemistry by Voet and Voet
4. Molecualr Cell Biology by Lodish et al
5. Molecular Biology of Genes by Watson et al.
6. Gene IX by Benjamin Lewin
7. Biothermal-Fluid Sciences Principles and Applications, by W-J Yang

| | | |
|---|---|---|
| **Subject Code:** | **B.Tech/Aero/14** | **Course Title :** ENGINEERING MECHANICS - II (DYNAMICS) |
| **Contact Hours** | **Lecture- 3** | **Tutorial-1** **Practical-0** **Credit-4** |
| **Objectives** | The aim of the course in Engineering Mechanics for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the fundamental principles governing the behavior of physical systems. This subject is designed to equip students with the analytical skills necessary to solve complex engineering problems related to forces, motio and equilibrium. | |
| **Content** | | |
| A vector treatment of the dynamics of particles and rigid bodies within the framework of Newtonian mechanics. Application to problems in aerospace engineering, including the elements of orbital mechanics, rocket mechanics and satellite dynamics. | | |

| **Subject Code:** | | **Course Title :** FLUID MECHANICS & HEAT TRANSFER |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the course on Fluid Mechanics and Heat Transfer is to provide B.Tech. students specializing in Aerospace with a comprehensive understanding of the fundamental principles governing fluid behavior and thermal dynamics. This knowledge is essential for the design and analysis of various aerospace systems and components. | |
| **Content** | | |
| **FLUID MECHANICS**: Introduction to fluids, Fluid statics; pressure as a scalar, manometry, forces on submerged surfaces , Description of flows; field approach, Euler acceleration formula, streamlines, streaklines, etc., Reynolds transport theorem Conservation of mass; stream function, Linear (NOT angular) Momentum balance, Navier Stokes (NS) equation; elementary derivation; application; Poiseuille flow, Couette flow, Energy equation Bernoulli equation, applications including flow measurement (Pitot tube, Orifice meters); Pipe flows and losses in fittings; Similitude and modelling: using nondimensionalization of NS equations and boundary conditions, simplifications for cases without free surfaces and without cavitation ; High Re flow: Prandtls approximation; basic inviscid flow; need for boundary layer; Magnus effect (mathematical derivations be avoided), Boundary layers elementary results for flat plates. Separation, flow past immersed bodies (bluff, streamlined);<br><br>**Heat Transfer:** Introduction, rate law and conservation law, Conduction equation; nondimensionalization, various approximations, Steady state conduction concept of resistances in series and of critical thickness of insulation, Unsteady conduction; significance of Biot and Fourier numbers, Heissler | | |

| **Subject Code:** | | **Course Title :** ENGLISH – I |
|---|---|---|
| **Contact Hours** | **Lecture- 2** | **Tutorial-1** **Practical-0** **Credit-3** |
| **Objectives** | The objective for the English course tailored for B.Tech. students specializing in Aerospace is to enhance their communication skills, both written and verbal, within a technical context. This course aims to equip students with the ability to articulate complex ideas clearly and effectively, fostering their proficiency in professional and academic settings.<br>Additionally, the curriculum will focus on developing critical reading and analytical skills, enabling students to engage with technical literature and research. By the end of the course, students should be able to produce coherent reports and presentations that meet industry standards, thereby preparing them for successful careers in the aerospace sector. | |
| **Content** | | |
| This course is meant to help the learner acquire fluency in reading and understanding English and writing with clarity and precision. These skills will be imparted through lectures and sessionals. While the lectures will introduce learners to the basics of reading and comprehension, the sessionals will encourage them to put this knowledge into practice. The lecture topics will consist of lessons in language, vocabulary and and grammar aided by one or more texts consisting of prose pieces and poems. In the sessionals the learners will be asked to read a passage and answer questions on it or to eleborate in writing on a given topic, paying attention to grammatical correctness and lucidity and precision of expression. | | |

| **Subject Code:** | | **Course Title :** BASIC ELECTRONICS |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-1** **Practical-0** **Credit-4** |
| **Objectives** | The aim of the BASIC ELECTRONICS course is to provide B.Tech. students specializing in Aerospace with a foundational understanding of electronic principles and applications. This curriculum is designed to equip students with essential knowledge and skills that are critical for their future endeavors in the aerospace field. Through this course, students will explore various electronic components, circuit design, and analysis techniques, fostering a comprehensive grasp of how these elements integrate into aerospace systems. The objective is to prepare students to effectively apply electronic concepts in practical scenarios relevant to their discipline. | |
| **Content** | | |
| Semiconductor basics. Electronic components and their operating principles.<br>Analog electronics: Rectifiers. Transistor circuits, amplifiers and oscillators; filters. Operational amplifiers.<br>Digital electronics: logic gates and Boolean functions; registers, counters, switches.<br>Basics of microprocessors**.** | | |

| **Subject Code:** | | **Course Title :** BASIC ELECTRONICS LAB |
|---|---|---|
| **Contact Hours** | **Lecture- 0** **Tutorial-0** **Practical-3** **Credit-2** | |
| **Objectives** | The aim of the laboratory work in the field of BASIC ELECTRONICS is to provide B.Tech. (Aerospace) students with practical experience and a deeper understanding of electronic principles and components. This hands-on approach is designed to enhance theoretical knowledge through experimentation and application. | |
| **Content** | | |
| 1. Familiarization with electronic components and usage of multimeter<br>2. Familiarization with oscilloscope, signal generator and further usage of multimeters<br>3. Frequency-response and square-wave testing of R-C, C-R and R-L networks<br>4. Voltage Rectifiers<br>5. Studies on Common-Emitter amplifiers<br>6. Studies on analog circuits using OP-AMP<br>7. Studies on logic gates | | |

| **Subject Code:** | | **Course Title :** MATHEMATICS -3 (Half Semester Course) |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-0** **Practical-0** **Credit-1.5** | |
| **Objectives** | The objective for the Mathematics curriculum tailored for B.Tech. students specializing in Aerospace Engineering is to equip them with essential mathematical skills and concepts. This foundation is crucial for understanding complex engineering principles and solving real-world problems encountered in the aerospace field. | |
| **Content** | | |
| Prerequisite: void Laplace Transform: Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First and second shifting properties, Laplace Transform of derivatives and integrals, unit step functions, Dirac delta-function, error function. Differentiation and integration of transforms, convolution theorem, inversion, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial and boundary value problems. Fourier Series: Periodic functions, Fourier series representation of a function, half range series, sine and cosine series, Fourier integral formula, Parseval's identity. Fourier Transform: Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting and time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems. Brief Introduction of Z-Transform, Mellin transform and Wavelet Transform. | | |

| **Subject Code:** | | **Course Title :** INTRODUCTION TO AEROSPACE ENGINEERING (Half Semester Course) |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-0** **Practical-0** **Credit-1.5** | |
| **Objectives** | The aim of the course titled INTRODUCTION TO AEROSPACE ENGINEERING is to provide B.Tech. (Aerospace) students with a foundational understanding of the principles and practices within the aerospace field. This course will cover essential topics that encompass the design, development, and operation of aircraft and spacecraft, equipping students with the necessary knowledge to pursue advanced studies in aerospace engineering. | |
| **Content** | | |
| History of atmospheric and exo-atmospheric flight. Aircraft and spacecraft anatomy and the nature of their structure. Properties of the atmosphere; the International Standard Atmosphere (ISA). Concepts of internal and external fluid flows. Aerospace vehicle layout and the aerodynamic forces and moments that act on them. The aerofoil and its aerodynamic characteristics. Vehicle propulsion including propellers, gas turbines and rockets. Flight in the various speed regimes. Satellites and spacecraft. | | |

| **Subject Code:** | | **Course Title :** SOLID MECHANICS |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the SOLID MECHANICS course for B.Tech. students specializing in Aerospace Engineering is to provide a comprehensive understanding of the principles governing solid materials and their behavior under various forces. This course will equip students with the necessary theoretical knowledge and practical skills to analyze and design aerospace structures effectively. | |
| **Content** | | |
| Uniaxial stress and strain. Stress-strain curve of a material.<br>Analysis of stress and deformation in members subject to axial, torsional, bending, and combined loading.<br>Column stability.<br>Generalized stress and strain and their properties. Elastic stress-strain relations; elastic constants. Principal stresses and strains in 2-D.<br>Strain measurement using strain gauges. | | |

| **Subject Code:** | | **Course Title :** MATERIALS AND MANUFACTURING PROCESSES |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-1** **Practical-0** **Credit-4** |
| **Objectives** | The aim of the course on Materials and Manufacturing Processes for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the various materials used in aerospace applications and the manufacturing techniques employed in their production. This knowledge is essential for the design and development of aerospace components that meet stringent performance and safety standards. | |

**Content**

Materials: Types of engineering materials. Crystal structure, defects, imperfections, and strengthening mechanisms. Mechanical properties, fracture mechanics, fatigue and creep, and material failures. Phase diagrams and transformations. Degradation of materials. Characteristics of ferrous and nonferrous metals and alloys, ceramics, polymers, and composite materials.

Manufacturing processes:

Basic concepts and principles of manufacturing; dimensions, fits & tolerances. Performing Processes: Casting, forging, rolling, drawing, extrusion, press tool work, plastic moulding and powder metallurgy. Joining Processes: Welding, brazing and crimping. Semi-finishing and finishing processes: Machining processes: Turning, shaping, drilling, milling and grinding. Non-traditional Processes: Abrasive jet machining, Ultrasonic machining, Electro-discharge machining, Electrochemical machining, laser beam machining & 3-D printing. Product Quality: Possible defects and their detection, assessment and remedy.

| **Subject Code:** | | **Course Title :** ENGLISH – II |
|---|---|---|
| **Contact Hours** | **Lecture- 2** | **Tutorial-1** **Practical-0** **Credit-3** |
| **Objectives** | The objective for the English course tailored for B.Tech. students specializing in Aerospace is to enhance their communication skills, both written and verbal, within a technical context. This course aims to equip students with the ability to articulate complex ideas clearly and effectively, fostering their proficiency in professional and academic settings.<br>Additionally, the curriculum will focus on developing critical reading and analytical skills, enabling students to engage with technical literature and research. By the end of the course, students should be able to produce coherent reports and presentations that meet industry standards, thereby preparing them for successful careers in the aerospace sector. | |
| **Content** | | |
| This course aims to impart to the learner fluency in spoken English. They should be able to express themselves clearly, logically, economically and politely, with due regard to the gender and culture of the audience.<br>The learner will be instructed through participation in elocution, debates, seminars and conversations, both with the instructor and their peers.<br>The learner will also be required to learn to communicate to an audience through graphical means such as slides. They will be expected to master the best practices for this form of communication. | | |

| Subject Code: | | Course Title : AERODYNAMICS - I |
|---|---|---|
| Contact Hours | Lecture- 3 | Tutorial-0 Practical-0 Credit-3 |
| Objectives | The objective of the Aerodynamics course for B.Tech. students specializing in Aerospace Engineering is to provide a comprehensive understanding of the principles governing fluid dynamics as they apply to aircraft and spacecraft design. This course aims to equip students with the necessary theoretical knowledge and practical skills to analyze and predict aerodynamic behavior in various conditions. | |
| **Content** | | |
| Aerofoil characteristics, Classical aerofoil theory â camber and thickness problems, The source and vortex panel numerical methods, Prandtl s lifting line theory, Lifting surface theory, The vortex lattice method and general 3-D panel method, Boundary layer characteristics. | | |

Books:

1. E L Houghton and A E Brock, Aerodynamics for Engineering Students,
2. Edward ArnoldE L Houghton and N B Carruthers,
3. Aerodynamics for Engineering Students, Edward ArnoldJ Katz and A E Plotkin,
4. Low Speed Aerodynamics, Cambridge University PressJ D Anderson, Jr.,
5. Fundamentals of Aerodynamics, McGraw-Hill International
6. H Schlichting, Boundary Layer Theory, McGraw-Hill

| **Subject Code:** | | **Course Title :** AERODYNAMICS LAB-I |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-0** **Practical-0** **Credit-3** | |
| **Objectives** | The aim of the laboratory work in the field of Aerodynamics for B.Tech. (Aerospace) students is to provide practical experience and enhance understanding of aerodynamic principles. This hands-on approach will facilitate the application of theoretical concepts learned in the classroom to real-world scenarios, thereby reinforcing the students' knowledge and skills in the discipline. | |
| **Content** | | |
| AE21001 Experiments related to measurement of pressure and boundary layer characteristics. | | |

| **Subject Code:** | | **Course Title :** HISTORY OF THE MODERN WORLD |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** **Practical-0** **Credit-3** |
| **Objectives** | The objective of the course titled HISTORY OF THE MODERN WORLD for B.Tech. (Aerospace) students is to provide a comprehensive understanding of significant historical events and developments that have shaped the contemporary world. This course aims to equip students with the analytical skills necessary to assess the impact of these events on modern society, technology, and international relations. | |

**Content**

The European Renaissance: decline in the powers of the Church, rise of science, technology and mechanized industry; growth of rationalism and secularism.

The eighteenth century: Effect of the American and French revolutions on the Western world. Rapid advance of science, technology and industry; growth of capitalism as an economic system. Colonialism takes hold in Asia; conflicts in Europe over colonial spoils.

The nineteenth century: Consolidation of colonialism in Asia and Africa, transfer of wealth from the colonies. Rapid advancement of science and technology. Industrialization begins to shape the world.

The twentieth century: The first world war. Karl Marx and his influence on modern social science, economics and politics. The Russian revolution and the birth of communism. Nationalist and anti-colonial movements in Asia and Africa. The second world war, decline of European military power, rise of the United States of America and the Soviet Union as world powers. India and other colonized nations gain freedom. Technological progress proceeds at speed.

Asia after the second world war: The Chinese revolution. The rebirth of Japan. The disintegration of the Soviet Union and the rise of China as a world power. The population crisis in Asia. The environment under serious attack from human activity.

| **Subject Code:** | | **Course Title :** INTRODUCTION TO AUTOMATIC CONTROL |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-1** **Practical-0** **Credit-4** |
| **Objectives** | The aim of the course titled INTRODUCTION TO AUTOMATIC CONTROL is to provide B.Tech. (Aerospace) students with a foundational understanding of automatic control systems. This subject will cover essential principles and methodologies that govern the behavior of dynamic systems, emphasizing their application within the aerospace domain. | |
| **Content** | | |
| System, open loop and closed loop control, typical objectives of control analysis of linear invariant systems: governing equations, input-output approach, free and forced-responses, impulse response, frequency response, transfer function and its graphical representation, Role of transfer function in stability, transient and forced responses, block diagram algebra and signal flow graph; Analysis of feedback control system; common control objectives, typical system layout, classical stability and error analysis; Modern approach using state variables; design of control systems: classical approach root locus and bode plot, modern approach regulator problem. Introduction to sampled data and digital systems analysis: general configuration and models, free and forced responses; dynamics of sensors and actuators used in aerospace systems, Longitudinal and lateral stability augmentation and autopilot systems, Automatic landing system. | | |

| **Subject Code:** | | **Course Title :** AEROSPACE STRUCTURES - I |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** **Practical-1** **Credit-4** |
| **Objectives** | The aim of the course on Aerospace Structures for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the fundamental principles and applications related to the design and analysis of aerospace structures. This includes an exploration of materials, structural mechanics, and the various factors influencing the performance and safety of aerospace vehicles. | |
| **Content** | | |
| Introduction to Flight Vehicle Structures, Flight-Vehicle Imposed Loads, Energy Methods of Structural Analysis; Theory of Elasticity in Three-dimensions, (Tensorial approach); Two-dimensional problem of Elasticity; Development of problem related to Aerospace Structures; Stress Analysis. | | |

**Books:**

T H G Megson, Aircraft Structures for Engineering Students, Edward ArnoldH Ashley, Engineering Analysis of Flight Vehicles, Addison WesleyD J Peery and J J Azar, Aircraft Structures, McGraw-HillB K Donaldson, Analysis of Aircraft Structures: An Introduction, McGraw-Hill

| **Subject Code:** | | **Course Title :** STRUCTURES LAB -I |
|---|---|---|
| **Contact Hours** | **Lecture- 0** | **Tutorial-0** **Practical-3** **Credit-2** |
| **Objectives** | The aim of the laboratory work in the course STRUCTURES for B.Tech. students specializing in Aerospace is to provide practical experience and enhance understanding of structural principles. This hands-on approach is designed to complement theoretical knowledge acquired in lectures, allowing students to apply concepts in real-world scenarios. | |
| **Content** | | |
| Experiments related to Material Behaviour,<br>Experimental Stress Analysis, and<br>Experimental Analysis of Structures. | | |

| **Subject Code:** | | **Course Title :** MECHANICS OF FLIGHT |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the course MECHANICS OF FLIGHT is to provide B.Tech. (Aerospace) students with a comprehensive understanding of the principles governing flight dynamics. This subject will cover essential concepts such as aerodynamics, propulsion, and stability, equipping students with the knowledge necessary to analyze and design aircraft systems effectively. | |
| **Content** | | |
| Forces and moments acting on an aircraft; the drag polar in the different speed regimes, Mach number effects. Aerodynamic efficiency, thrust to weight ratio, load factor. Thrust and power characteristics of propeller powered and jet powered aircraft.<br>Equations of motion of quasi-static aircraft performance. Steady level flight, absolute and service ceilings, range and endurance; climbing flight, fastest and steepest climb programmes; turning flight, sharpest and quickest turns; takeoff and landing - for propeller powered and jet powered aircraft.<br>The V-n diagram.<br>The method of energy-height to analyse the climb performance of high thrust to weight ratio aircraft. | | |

**Books:**

1. E L Houghton and A E Brock, Aerodynamics for Engineering Students,
2. Edward ArnoldE L Houghton and N B Carruthers,
3. Aerodynamics for Engineering Students, Edward Arnold
4. N X Vinh, Flight Mechanics of High Performance Aircrafts, Cambridge University Press
5. A C Kermode, Mechanics of Flight, Himalayan Books/Pitman

| | | |
|---|---|---|
| **Subject Code:** | | AERODYNAMICS - II |
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the AERODYNAMICS course for B.Tech. students specializing in Aerospace Engineering is to provide a comprehensive understanding of the principles governing fluid dynamics as they apply to aircraft and spacecraft design. This course will equip students with the necessary theoretical knowledge and practical skills to analyze and predict aerodynamic behavior in various conditions. | |
| **Content** | | |
| Governing equations for compressible flow; One-dimensional compressible flow, linear and nonlinear wave motion; normal and oblique shocks, nozzles; Linearized subsonic and supersonic flow theory; Applications to aerofoils and wings; Supersonic panel methods; Method of characteristics; Transonic and hypersonic flows. | | |

Books:


1. A H Shapiro, Dynamics and Thermodynamics of Compressible Fluid Flow â Volume I and II, Ronald PressH W Liepmann and
2. A Roshko, Elements of Gas Dynamics, John WileyJ D Anderson, Jr., Modern Compressible Aerodynamics, McGraw-Hill InternationalZ U
3. A Warsi, Fluid Dynamics: Theoretical and Computational Approach, Taylor and FrancisP A Thompson, Compressible Fluid Dynamics, McGraw-HillS Goldstein,
4. Modern Developments in Fluid Dynamics â Vol. 1 and 2, Oxford University Press

| **Subject Code:** | | **Course Title :** AERODYNAMICS LAB-II |
|---|---|---|
| **Contact Hours** | **Lecture- 0** | **Tutorial-0** **Practical-3** **Credit-2** |
| **Objectives** | The aim of the laboratory work in the field of Aerodynamics for B.Tech. (Aerospace) students is to provide practical experience and enhance understanding of aerodynamic principles. This hands-on approach allows students to apply theoretical knowledge to real-world scenarios, fostering critical thinking and problem-solving skills essential for their future careers. | |
| **Content** | | |
| Laboratory experiments related to pressure and force measurement on various models using different measuring techniques;<br>Supersonic wind tunnel experiments and flow visualization. | | |

| **Subject Code:** | | **Course Title :** AEROSPACE STRUCTURES - II |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the course on Aerospace Structures for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the fundamental principles and applications related to the design and analysis of aerospace structures. This includes an exploration of materials, structural mechanics, and the various factors influencing the performance and safety of aerospace vehicles. | |
| **Content** | | |
| Analysis of Aircraft Structures; Thin-walled structures based on elasticity approach; Torsion, bending and shear of open and closed thin-walled cells; Structural instability; Buckling of columns, linear and nonlinear theories, Southwell method, inelastic buckling, buckling under nonconservative forces. | | |

Books:

1. T H G Megson, Aircraft Structures for Engineering Students, Edward ArnoldH Ashley, Engineering Analysis of Flight Vehicles, Addison WesleyC K Wang,
2. Introductory Structural Analysis with Matrix Method, Englewood Cliffs, Prentice HallE F Bruhn,
3. Analysis and Design of Aircraft Structures, Tri-State Offset CoE E Sechler and L G Dunn, Airplane Structural Analysis and Design, Dover

| **Subject Code:** | | **Course Title :** STRUCTURES LAB -II |
|---|---|---|
| **Contact Hours** | **Lecture- 0** **Tutorial-0** **Practical-3** **Credit-2** | |
| **Objectives** | The aim of the laboratory work in the course STRUCTURES for B.Tech. students specializing in Aerospace is to provide practical experience and enhance understanding of structural principles. This hands-on approach is designed to complement theoretical knowledge acquired in lectures, allowing students to apply concepts in real-world scenarios. | |
| **Content** | | |
| Experiments related to Material Behaviour, Experimental Stress Analysis, and Experimental Analysis of Structures | | |

| **Subject Code:** | | **Course Title :** AEROSPACE PROPULSION |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the course AEROSPACE PROPULSION for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of propulsion systems used in aerospace applications. This includes the study of various types of engines, their design principles, and operational mechanisms. | |
| **Content** | | |
| (The basics of thermodynamics should have been covered in the Physics course in Sem.1) Axial Compressor and its performance; Elementary Theory of Turbines; Injectors and Fuel Injection, Combustion Chamber performance; Design Procedure. | | |

Books:

1. J D Mattingly, Elements of Gas Turbine Propulsion, McGraw-Hill
2. J D Mattingly, W H Heiser, D H Daley, Aircraft Engine Design, AIAAS
3. L Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery, Pergamon Press
4. H Cohen, G F C Rogers, and H Saravanamutto, Gas Turbine Theory, Longman

| **Subject Code:** | | **Course Title :** PROPULSION LABORATORY |
|---|---|---|
| **Contact Hours** | **Lecture- 0 Tutorial-0 Practical-3 Credit-2** | |
| **Objectives** | The aim of the laboratory work in the field of Aerospace Propulsion for B.Tech. (Aerospace) students is to provide practical experience and enhance understanding of propulsion systems. This hands-on approach will enable students to apply theoretical concepts learned in the classroom to real-world scenarios, fostering a deeper comprehension of the principles governing aerospace propulsion. | |
| **Content** | | |
| Measurement of fan,<br>compressor, turbine and nozzle characteristics;<br>combustion related measurements. | | |

| **Subject Code:** | | **Course Title :** AIRCRAFT STABILITY AND CONTROL |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the course on Aircraft Stability and Control for B.Tech. Aerospace students is to provide a comprehensive understanding of the principles governing the stability and control mechanisms of aircraft. This subject will equip students with the necessary theoretical knowledge and practical skills to analyze and design stable flight systems. | |
| **Content** | | |
| Introduction to the problem of stability and control. Longitudinal static stability, controls fixed and controls free; longitudinal control and maneuvering in steady flight in the vertical plane; longitudinal control in takeoff and landing. Lateral-directional static stability and control: weathercock stability, rolling manoeuvres; lateral-directional control during takeoff and landing.<br>Dynamic stability analysis: the equations of motion of a rigid aircraft and their linearization; the aerodynamic stability derivatives; analysis of longitudinal dynamic stability; analysis of lateral-directional dynamic stability analysis. Response of the aircraft to longitudinal and lateral-directional control inputs; flying qualities. Response of the aircraft to gusts. | | |

Books:

1. B Etkin, Dynamics of Atmospheric Flight, John WileyE L Houghton and
2. A E Brock, Aerodynamics for Engineering Students, Edward Arnold E L Houghton and N B Carruthers.
3. Aerodynamics for Engineering Students, Edward Arnold

| **Subject Code:** | | **Course Title :** MECHANICAL VIBRATIONS |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-1** **Practical-0** **Credit-4** | |
| **Objectives** | The aim of the course on Mechanical Vibrations is to provide B.Tech. students specializing in Aerospace with a comprehensive understanding of the principles and applications of vibration analysis. This subject will equip students with the necessary skills to analyze and mitigate vibrational issues in aerospace structures and systems. | |
| **Content** | | |
| Free vibration of a single degree of freedom spring-mass system; effect of viscous damping, logarithmic decrement, critical damping ratio; effect of Coulomb damping (dry friction). Harmonically forced vibration of a single degree of freedom spring-mass system: frequency response, sharpness of resonance; amplitude gain and maximally flat response. Vibration measuring instruments. Rotating unbalance, whirling of rotating shafts, support motion. Impulsive and arbitrary excitation.<br>Free vibration of a two d.o.f. system: natural frequencies, normal modes and mode shapes; the viscous vibration damper. Forced vibration and the tuned mass vibration absorber.<br>Free vibration of multi-degree of freedom systems: the stiffness and flexibility matrices; natural frequencies as eigenvalues and normal modes as eigenvectors of the stiffness matrix; the modal matrix. Matrix iteration method for the determination of the fundamental and higher frequencies.<br>Free vibration of continuous systems: vibrating string; longitudinal vibration of a rod; torsional vibration of a rod; transverse vibration of Euler beams.<br>Approximate methods for multi-degree of freedom systems: lumped mass equivalent of a continuous system; Rayleigh’s and Dunkerley’s methods. | | |

| **Subject Code:** | | **Course Title :** AVIONICS |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-1** **Practical-0** **Credit-4** |
| **Objectives** | The objective for the subject of Avionics for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the electronic systems used in aircraft and spacecraft. This includes the study of navigation, communication, and control systems, equipping students with the necessary knowledge to design, analyze, and implement these technologies effectively. | |
| **Content** | | |
| Introduction to electronics circuits, amplifier and oscillator; Aircraft communication system, transmitter, receiver, antenna; Aircraft navigation equipments, ADF, VOR, ILS, Loran; Principles of radar operation, radar equipments, air traffic control, DME, transponder, IFF, GCA; Aircraft pilotage systems | | |

| **Subject Code:** | | **Course Title :** SPACE MECHANICS |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-0** **Practical-0** **Credit-3** | |
| **Objectives** | The aim of the SPACE MECHANICS course for B.Tech. (Aerospace) students is to provide a comprehensive understanding of the principles and applications of mechanics in space environments. This course will equip students with the necessary theoretical knowledge and practical skills to analyze and solve problems related to spacecraft dynamics and orbital mechanics. | |
| **Content** | | |
| Orbital mechanics: Orbital elements, determination of orbits, effect of small impulses on orbital elements. Orbital manoeuvres: orbit transfers, rendezvous, docking. Orbital decay due to atmospheric friction. Space trajectories for interplanetary travel.<br>Elementary principles of rocket mechanics, launch vehicle staging and optimization. Powered flight trajectories. Ion propulsion.<br>Satellite dynamics, attitude control and attitude manoeuvring. | | |

| | | |
|---|---|---|
| **Subject Code:** | | **Course Title:** INTRODUCTION TO MACRO- AND MICRO-ECONOMICS |
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** **Practical-0** **Credit-3** |
| **Objectives** | The aim of the course titled INTRODUCTION TO MACRO- AND MICRO-ECONOMICS is to provide B.Tech. (Aerospace) students with a foundational understanding of economic principles at both macro and micro levels. This course will equip students with the analytical tools necessary to comprehend economic systems and their impact on various sectors, including aerospace. | |

**Content**

Introduction to macro and microeconomic principles, problems, and policies.

Macroeconomics: Introductory analysis of employment, inflation, recession, economic growth and international trade.

Microeconomics: Basic financial principles such as time value of money, project evaluation methods, depreciation and inflation, applicable taxes, capital budgeting, sensitivity and risk analysis, and costing of projects.

| **Subject Code:** | | **Course Title:** NUMERICAL METHODS IN AEROSPACE ENGINEERING |
|---|---|---|
| **Contact Hours** | **Lecture- 3** **Tutorial-0** **Practical-0** **Credit-3** | |
| **Objectives** | The aim of the course on Numerical Methods in Aerospace Engineering is to equip B.Tech. Aerospace students with essential computational techniques. This subject focuses on the application of numerical analysis to solve complex engineering problems encountered in the aerospace field. | |
| **Content** | | |
| Accumulation and propagation of roundoff errors in finite-precision numerical calculation.<br>Solution of linear systems of equations: direct methods; iterative methods, basic theory of linear fixed-point iteration, successive overrelaxation (SOR); conjugate gradients.<br>Matrix eigenvalue and eigenvector computations: power method, QR iteration.<br>Interpolation on evenly spaced and unevenly spaced intervals.<br>Curve fitting: method of least squares; method of cubic splines.<br>Numerical integration: Trapezoidal and Simpson's rules, Romberg integration; Gaussian quadrature.<br>Finite difference approximation using forward, backward and central difference schemes; truncation error; differences of higher accuracy.<br>Numerical solution of ordinary differential equations: Runge Kutta methods of different orders; multistep methods. Boundary value problems: the "shooting method", finite-difference method, Galerkin's method.<br>Numerical solution of linear partial differential equations: the Laplace equation; the heat equation in 1-D; the wave equation in 1-D. | | |

| **Subject Code:** | | **Course Title:** NUMERICAL METHODS IN AEROSPACE ENGINEERING LAB |
|---|---|---|
| **Contact Hours** | **Lecture- 0** **Tutorial-0** **Practical-3** **Credit-2** | |
| **Objectives** | The aim of the laboratory work in the course of Numerical Methods in Aerospace Engineering is to provide B.Tech. students specializing in Aerospace with practical experience in applying numerical techniques to solve engineering problems. This hands-on approach is designed to enhance their understanding of theoretical concepts through real-world applications. | |
| **Content** | | |
| Students will write and execute computer programs to implement the numerical methods taught in the lecture classes. | | |

| **Subject Code:** | | **Course Title:** PRINCIPLES OF AIRCRAFT DESIGN |
|---|---|---|
| **Contact Hours** | **Lecture- 1 Tutorial-0 Practical-3 Credit-3** | |
| **Objectives** | The aim of the course on PRINCIPLES OF AIRCRAFT DESIGN is to provide B.Tech. (Aerospace) students with a comprehensive understanding of the fundamental concepts and methodologies involved in aircraft design. This curriculum is designed to equip students with the necessary skills to analyze and develop aircraft systems effectively. | |
| **Content** | | |
| Civil aircraft categories and the regulations governing their performance requirements. Goals and specifications in aircraft design. Survey of existing aircraft of similar specifications regarding performance and layout. Aerodynamic design: basic configuration, wing planform, fuselage shape; preliminary weight and centre of gravity estimation; sizing of fuselage, wing and stabilizing surfaces; estimation of drag. Power plant selection. Preliminary performance calculation. Structural design: estimation of structural loads under various flight conditions; structural layout; structural design of the wing, fuselage and landing gear. Fuel weight calcuation. Refined weight and centre of gravity estimation; calculation of stability and control parameters; checking for adequacy of dynamic stability and response. | | |

| **Subject Code:** | | **Course Title:** SUMMER TRAINING/INTERNSHIP |
|---|---|---|
| **Contact Hours** | **Lecture- 0** **Tutorial-0** **Practical-0** **Credit-2** | |
| **Objectives** | The aim of the summer training or internship for B.Tech. students specializing in Aerospace is to provide practical experience and enhance their understanding of the field. This opportunity allows students to apply theoretical knowledge in real-world scenarios, fostering professional growth and skill development. | |

| **Subject Code:** | | **Course Title:** AIRCRAFT MAINTENANCE – I |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** **Practical-0** **Credit-3** |
| **Objectives** | The objective for the course on Aircraft Maintenance for B.Tech. students specializing in Aerospace Engineering is to equip learners with essential knowledge and practical skills necessary for the effective maintenance of aircraft systems. This program aims to foster a comprehensive understanding of maintenance protocols, safety regulations, and the technical aspects involved in ensuring aircraft reliability and performance. | |

**Content**

1. **Hydraulic System:** Relationship between pressure , force and area and methods of solving problems related to differential area and pressure, mechanical advantages , Pascal's law, and problem solving, identification hydraulic fluid by name, MIL specification or colors and properties and precautions to be observed when using them.
2. **Pneumatic System:** Principles and uses of high pressure air system in n aircraft, Identification of components and their construction features and functions and the effects of faults in a pneumatic system, System using bleed air values , mass flow, pressure ad temperature control, and their identification, Alternate power supply, -APU and Ground cart.
3. **Landing Gear System:** Construction feature, and disadvantages of different types, description, assembly, principles of operation of different types of landing gears, Description of system testing-ground and flight.
4. **Types of Landing gears:** Advantages and disadvantages of different types, description, assembly, principles of operation of different types of landing gears,, Discerption of testing –ground and flight.
5. **Brakes :** Construction, operation, function and maintenance of single and duel servo brakes, expander tube brakes (Hydraulic & Pneumatic) , disc brakes, (Single & Multi) , and master cylinder, Inspection of undercarriage for absorption legs, wheels and tyres, Principles of operation of aircraft following heavy landing and overweight landing.
6. **Fuel System :** Construction operation, function, Inspection, and maintenance of the - Pumps, Strainers, Valves, Filters, Tanks, Fuel heaters and Primers, Identification and location of fuel system components, Layouts and operation of typical piston gas turbine engine aircraft fuel system including instrument and electrical interface.
7. **Air conditioning System :** Definitions of Sensible heat, Latent heat, adiabatic conduction, convection, and radiation, Carle's law and how this relates to transfer of energy in air – condition system, Identification of Compressor, evaporator, receiver, dryer, expansion valves, condensers, lowers, and Isolation valves, vapor cycle system, construction , principle of operation, location and function of typical system.

| **Subject Code:** | | **Course Title:** AIRCRAFT MAINTENANCE WORKSHOP - I |
|---|---|---|
| **Contact Hours** | **Lecture- 0** | **Tutorial-0** **Practical-3** **Credit-2** |
| **Objectives** | The aim of the SAIRCRAFT MAINTENANCE workshop is to provide B.Tech. (Aerospace) students with practical knowledge and skills essential for aircraft maintenance. This workshop will focus on the fundamental principles and techniques involved in ensuring the safety and efficiency of aircraft operations. | |
| **Content** | | |
| Practical's on Units under Aircraft Maintenance-I by Visits on the Aircraft Maintenance Hanger/ Workshop at Flying Club or Engineering Workshop and airline at an Airport. | | |

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|---|---|---|---|---|
| **Subject Code:** | | **Course Title: ELECTIVE-I** | | |
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** | **Practical-0** | **Credit-3** |
| **Objectives** | | | | |
| **Content** | | | | |
| **(A Separate Section for the Syllabi of Electives has been given at the end of Syllabi of core subjects)** | | | | |

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|---|---|---|---|---|---|
| **Subject Code:** | | **Course Title: ELECTIVE-II** | | | |
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** | **Practical-0** | **Credit-3** | |
| **Objectives** | | | | | |
| **Content** | | | | | |
| **(A Separate Section for the Syllabi of Electives has been given at the end of Syllabi of core subjects)** | | | | | |

| **Subject Code:** | | **Course Title:** INTRODUCTION TO THE PRINCIPLES OF MANAGEMENT |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** **Practical-0** **Credit-3** |
| **Objectives** | | |

**Content**

1. **Nature of Management:** meaning and Importance of Management-Definition and Function of Management-Social Responsibility of Management, Limitation of the management.
2. **Growth of Management:** Origin and Development of Management, Recent Trends in Management Thoughts, School of management Thoughts**,** Evaluation of management Thoughts, Scientific Management, Mental revaluation, Henri Fayol-Management Development in India, Management as a Profession.
3. **Levels of Management:** Different levels of Management, Function & duties of Top and Middle Order Management, Chief Executive of the Enterprise, Functional areas of management.
4. **Functional Areas of management:** Production/ Operation Management, Financial management, Supply Chain-Distribution Management, Marketing Management, Marketing research, Purchasing Management, materials Management, Personnel /Human Resource management.
5. **Business Forecasting:** meaning and significance of forecasting, Elements of Business Forecasting, Need, Kinds, Economics, Direct and Joint Opinion Method of Techniques of Forecasting.
6. **Planning :** meaning, Nature & Scope of Planning, Steps in Planning, Elements, Limitation and Importance of Planning.
7. **Decision Making:** Meaning & Importance of Decision Making, Important steps in decision making, Different principles of decision making, Classification of Decision making.
8. **Leadership:** Concept and Importance, Theories of leadership, Leadership Qualities, Basis of Leadership.
9. **Motivation:** Meaning and elements of motivation, Importance and methods of Motivation, Problems of Motivation, Moral.
10. **Direction:** Meaning, Nature, and Scope of Direction, Getting Things Done-Principles of Direction.
11. **Communication:** meaning, Purpose, and Principles of Communication, methods of Communication, Channels of Command in Communication, Vrabl Vs. Written Communication.
12. **Control:** Nature & Scope of Control, Basic Elements of Control, Pre-Rqusite of Control System.

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|---|---|---|---|---|---|
| **Subject Code:** | | **Course Title: ELECTIVE-III** | | | |
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** | **Practical-0** | **Credit-3** | |
| **Objectives** | | | | | |
| **Content** | | | | | |
| **(A Separate Section for the Syllabi of Electives has been given at the end of Syllabi of core subjects)** | | | | | |

| **Subject Code:** | | **Course Title:** COMPREHENSIVE VIVA VOCE | | |
|---|---|---|---|---|
| **Contact Hours** | **Lecture- 0** | **Tutorial-0** | **Practical-0** | **Credit-2** |
| **Objectives** | | | | |
| **Content** | | | | |
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|---|---|---|---|---|---|
| **Subject Code:** | | **Course Title: ELECTIVE-IV** | | | |
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** | **Practical-0** | **Credit-3** | |
| **Objectives** | | | | | |
| **Content** | | | | | |
| **(A Separate Section for the Syllabi of Electives has been given at the end of Syllabi of core subjects)** | | | | | |

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|---|---|---|---|---|
| **Subject Code:** | | **Course Title: ELECTIVE-V** | | |
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** | **Practical-0** | **Credit-3** |
| **Objectives** | | | | |
| **Content** | | | | |
| **(A Separate Section for the Syllabi of Electives has been given at the end of Syllabi of core subjects)** | | | | |

| **Subject Code:** | | **Course Title:** AIRCRAFT MAINTENANCE – II |
|---|---|---|
| **Contact Hours** | **Lecture- 3** | **Tutorial-0** **Practical-0** **Credit-3** |
| **Objectives** | The objective for the course on Aircraft Maintenance for B.Tech. students specializing in Aerospace Engineering is to equip learners with essential knowledge and practical skills necessary for the effective maintenance of aircraft systems. This program aims to foster a comprehensive understanding of maintenance protocols, safety regulations, and the technical aspects involved in ensuring aircraft reliability and performance. | |

**Content**

1. **Pressurization System:** Definitions of pressure altitude, different pressure, maximum differential, controlled leaks and uncontrolled leaks, isobaric control made, different control made, Identification and principle of operation of pressure controllers, outflow values, safety valves, cabin altimeters, cabin, differential indicators, cabin rate of climb indicators, pneumatic relays ,manual pressure, control valves, Diagnosis of faults in aircraft pressurization system and rectification.
2. **Oxygen System :** Description of Human requirement for Oxygen verses altitude including effect of Oxygen, means of identification oxygen cylinders, and chemical units for use in aircrafts, Safety precautions to be observed during servicing and maintenance of oxygen systems.
3. **Fire detection and Protection Systems:** Description of three methods of controlling fire, Constriction, Operation a, testing , troubleshooting and maintenance of fire detection systems _: Thermal switch, Thermocouple, continues loop, continues element of pressure type sensor responders. Description of typical fire extinguisher system fitted to both reciprocating in gas turbine engine aircraft, inspection and maintenance of detection and extinguish system , properties of extinguish agent.
4. **De-Icing & Anti-Icing Systems:** Description of the effects of Ice on aircraft, Construction, operation, function, inspection, maintenance, and typical layout of Anti-ice System (Electrical, chemical, thermal) ,Deicing system (Electrical, chemical, thermal), Chemical rain replant systems, pneumatic rain removal, Ice –detection system, water and toilet drains, heaters and wind shield wipers, Requirement of ground icing of aircraft.
5. **Ignition System:** Requirement of Gas turbine system, Induction type ignition system, High Voltage Capacitor system with DC/AC input, Low Voltage capacitor System with DC/AC input , AC input system ignition system Vs. Low voltage igination system, Igniter Types, Functions, & Servicing , Glow plug ignition system.
6. **Starting System :** Knowledge of construction features and function of various types of engine starters – Electric Motors starters, Starter generator, Air Turbine starter, Ground & Air Born APU, Fuel –Air Combustion starter.
7. **Engine Maintenance :** Knowledge of trouble shooting of minor defects and methods of their rectification, ridging of engine controls and field adjustment of fuel control unit, periodical inspections necessary to check the serviceability of the engine ; special inspection schedules, duplicate inspection of engine controls, Detailed knowledge of engine starting , ground run-ip, trimming and checking of performance of the engine and its components including systems, knowledge of the condition monitoring and performance monitoring of gas turbine engines, Knowledge of engine preservation and de-preservation procedure.

| **Subject Code:** | | **Course Title:** AIRCRAFT MAINTENANCE WORKSHOP - II |
|---|---|---|
| **Contact Hours** | **Lecture- 0** **Tutorial-0** **Practical-3** **Credit-2** | |
| **Objectives** | The aim of the SAIRCRAFT MAINTENANCE workshop is to provide B.Tech. (Aerospace) students with practical knowledge and skills essential for aircraft maintenance. This workshop will focus on the fundamental principles and techniques involved in ensuring the safety and efficiency of aircraft operations. | |
| **Content** | | |
| Practical's on Units under Aircraft Maintenance-II by Visits on the Aircraft Maintenance Hanger/ Workshop at Flying Club or Engineering Workshop and airline at an Airport. | | |

| Subject Code: | | Course Title: AVIATION MANAGEMENT |
|---|---|---|
| Contact Hours | Lecture- 3 Tutorial-0 Practical-0 Credit-3 | |
| Objectives | The aim of the Aviation Management course for B.Tech. (Aerospace) students is to equip them with essential knowledge and skills pertinent to the aviation industry. This program focuses on various aspects of aviation operations, including regulatory frameworks, safety management, and strategic planning. | |
| **Content** | | |
| **Introduction to Aviation Industry:** Definition and scope of the aviation industry, Historical development and evolution of aviation – Global & India. | | |
| **Segments of the Aviation Industry:** Commercial aviation (passenger and cargo), General aviation, Military aviation, and others. | | |
| **Regulatory bodies & Regulations in Aviation in India:** DGCA, BCAS, AERA, Customs, Immigration, Important aspects of Aircraft Act-1934 & Aircraft Rule-1937. | | |
| **Role & significance of International Bodies in Aviation:** ICAO, IATA, and ACI. | | |
| **Major Civil Aviation Policies of Government of India :** National Civil Aviation Policy 2016, Greenfiled Airport Policy and procedure of MOCA. | | |
| **Aviation Regulations and Compliance:** International and national aviation regulations, Certification processes for airlines and airports, Compliance with safety and environmental standards. | | |
| **Airline Business Models:** Full-service carriers vs. low-cost carriers, Regional and niche carriers, Cargo airlines and their role. | | |
| **Environmental Sustainability in Aviation:** Environmental impact of aviation, Sustainable practices and initiatives, Green technologies in Aviation. | | |
| **Safety Management Systems (SMS):** Principles and components of Safety Management Systems. Implementing SMS for proactive risk management and incident prevention, Fundamental of Safety Management System. | | |

**Text& Reference Books:**


1. AEROSPACE: The Journey of Flight, 2nd Edition.
2. Civil Air Transfer, W.S.Barry, Routledge Taylors & Francis Group, London.
3. ICAO Annexure 19-Safety Management.

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|---|---|---|
| **Subject Code:** | **B.Tech./Aero/58** | **Course Title:** PROJECT |
| **Contact Hours** | **Lecture- 0 Tutorial-0 Practical-6 Credit-4** | |
| **Objectives** | | |
| **Content** | | |
| **PROJECT Work** | | |

# Electives

## A: Aerodynamics

| Subject Code: | | Course Title: Computational Fluid Dynamics |
|---|---|---|
| Contact Hours | Lecture- 3 Tutorial-0 Practical-0 Credit-3 | |
| Objectives | The aim of the Computational Fluid Dynamics course for B.Tech. students specializing in Aerospace Engineering is to equip them with a comprehensive understanding of fluid flow principles and numerical methods. This course will enable students to analyze and simulate fluid behavior in various aerospace applications, fostering their ability to solve complex engineering problems. | |
| Content | | |
| Introduction to grid generation; various grid generation techniques; finite difference method, convergence and stability, explicit and implicit methods; finite difference method applied to model equations; Numerical solutions Euler equations, incompressible and compressible Navier-Stokes equations, Concepts of flux splitting and limiters. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Advanced computational fluid dynamics (prerequisite: 1)** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course in Advanced Computational Fluid Dynamics is to equip B.Tech. students specializing in Aerospace with a comprehensive understanding of fluid dynamics principles and computational techniques. This subject will enhance their ability to analyze and solve complex fluid flow problems relevant to aerospace applications. | |
| **Content** | | |
| Turbulence modeling and Numerical Solution of Navier-Stokes Equations for turbulent flows, Application of CFD methods to stability and acoustic problems, ENO and DRP schemes, Introduction to multiphase/multi-component, Introduction to weighted residual methods in CFD and applications. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Industrial Aerodynamics** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The objective of the Industrial Aerodynamics course for B.Tech. students specializing in Aerospace Engineering is to provide a comprehensive understanding of aerodynamic principles as they apply to industrial applications. This course aims to equip students with the necessary theoretical knowledge and practical skills to analyze and solve complex aerodynamic problems encountered in various engineering contexts. | |
| **Content** | | |
| Historical background, wind-data, basic shape factors, bluff body aerodynamics, Wind tunnels and measurement techniques, Dynamic effects, aeroelastic phenomena, Application to buildings, chimneys, towers, bridges, automobiles, etc; Design practice, case studies. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Theory of viscous flows** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on the Theory of Viscous Flows for B.Tech. students specializing in Aerospace Engineering is to provide a comprehensive understanding of fluid dynamics, particularly focusing on the behavior of viscous fluids. This subject will equip students with the theoretical foundations and practical applications necessary for analyzing and solving complex flow problems encountered in aerospace contexts. | |
| **Content** | | |
| Review of incompressible and compressible viscous flow equations of motion, vorticity transport equation and Vorticity dynamics; Low and High Reynolds number flows; Separated flows and wakes; Laminar and Turbulent Flows; Boundary-layer flows, Transition process and prediction; Turbulent stresses and heat transfer; Equilibrium, entrainment and lag in boundary layer flows; First and second-order boundary layer theory; Differential and integral methods of solution; Viscous-Inviscid interaction; Direct, inverse and semi-inverse coupling. Books:G K Batchelor, An Introduction to Fluid Dynamics, Cambridge University PressF M White, Viscous Fluid Flow, McGraw-Hill InternationalH Schlichting, Boundary Layer Theory, McGraw-HillS Goldstein, Modern Developments in Fluid Dynamics â Vol. 1 and 2, Oxford University Press | | |

**Elective : B: Aircraft Structures**

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|---|---|---|
| **Subject Code:** | | **Course Title: Finite element method** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Aircraft Structures and the Finite Element Method is to provide B.Tech. students specializing in Aerospace Engineering with a comprehensive understanding of structural analysis techniques. This curriculum is designed to equip students with the necessary skills to apply finite element analysis in the evaluation and design of aircraft structures. | |
| **Content** | | |
| Variational principles in structural analysis, general finite element formulation using assumed displacement models, convergence requirements, finite element structural analysis using simple bar, beam, and two-dimensional plane stress elements. Shape functions, rectangular elements. Lagrange family and serendipity family, natural co-ordinates: interpolation fields for triangular elements. Isoparametric formulation; two-dimensional elements, Gauss quadrature, and elements for axial symmetry: plate elements, finite element free vibration analysis of bars and beams, weighted residual and Galerkin methods, finite element modeling and programming. | | |

| | | |
|---|---|---|
| **Subject Code:** | | **Course Title: Advanced finite element method (prerequisite: 1)** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Aircraft Structures, focusing on advanced finite element methods, is to equip B.Tech. Aerospace students with a comprehensive understanding of structural analysis techniques. This subject will delve into the application of finite element analysis in the design and evaluation of aircraft structures, emphasizing both theoretical concepts and practical implementations. | |
| **Content** | | |
| Sources of nonlinearities in structural problems: material, geometry, forces, boundary conditions; General features of nonlinear response: equilibrium trajectories, path dependencies, critical points, Geometrically nonlinear finite elements: residual and incremental forms. Finite element Total Lagrangian and corotational formulations, FEM nonlinear equilibrium equations: initial stress, tangent and secant stiffness, geometric stiffness; Solution of nonlinear equations: classification, incremental control techniques, augmented equation methods, incremental and pseudo-force methods, Newton Methods, Secant (quasi-Newton) methods, Acceleration and line search, dynamic relaxation, determination and transversal of critical points. Computer implementation: model definition, element level calculation, equation assembly, nonlinear equation solver, residual evaluation, post-processing, Nonlinear constitutive models, Applications to structural stability analysis and bifurcations, nonlinear static analysis and nonlinear transient problems (implicit vs. explicit time integration techniques), Treatment of constraints | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Composite structures** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Aircraft Structures, specifically focusing on Composite Structures, is to provide B.Tech. (Aerospace) students with a comprehensive understanding of the principles and applications of composite materials in aviation. This subject will cover the fundamental concepts, design methodologies, and performance characteristics of composite structures used in aircraft. | |
| **Content** | | |
| Introduction, classification and applications; Anisotropic elasticity, unidirectional and anisotropic lamina, thermomechanical properties, micromechanical analysis, Classical composite lamination theory cross-and angle-ply laminates, symmetric, antisymmetric and general asymmetric laminates, mechanical coupling. Analysis of simple laminated structural elements, lamina failure theories, first ply failure, vibration and buckling analysis. Sandwich structures, secondary failure modes. Manufacturing of composites. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Fracture Mechanics** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the Aircraft Structures-Fracture Mechanics course for B.Tech. (Aerospace) students is to provide a comprehensive understanding of the principles and applications of fracture mechanics in the context of aircraft structures. This course will equip students with the necessary knowledge to analyze and predict the behavior of materials under stress, particularly in relation to crack propagation and failure mechanisms. | |
| **Content** | | |
| Mechanisms of fracture and crack growth, elastic crack tip stress field, crack-tip plastic zones, stress intensity factor, Energy principle and criteria for crack growth, Plane strain and plane stress fracture toughness, crack-opening displacement criterion, fatigue crack propagation under constant and variable amplitude loading, crack closure, effective stress intensity range, Concept of safe-life, fail-safe and damage tolerance in aircraft design, Linear damage accumulation theory, Aircraft safe fatigue life. | | |

| | | |
|---|---|---|
| **Subject Code:** | | **Course Title: Vibration instrumentation & control** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Aircraft Structures-Vibration Instrumentation and Control is to equip B.Tech. (Aerospace) students with a comprehensive understanding of the principles and techniques related to vibration analysis and control in aircraft structures. This subject will cover the fundamental concepts of vibration, the methods of instrumentation, and the strategies for effective control, ensuring that students are well-prepared for practical applications in the aerospace industry. | |
| **Content** | | |
| Introduction, Transducers, Strain gauges and strain measurements, Calibration, Vibration testing machines, frequency response measurements, frequency analysis, types of signals, the frequency analyzers, Real time analysis, digital analysis, Signal conditioning, Vibration control, active and passive control. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Aeroelasticity** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the Aircraft Structures-Aeroelasticity course for B.Tech. (Aerospace) students is to provide a comprehensive understanding of the interaction between aerodynamic forces and structural responses in aircraft. This subject will equip students with the necessary theoretical knowledge and practical skills to analyze and design aircraft structures that can withstand various aerodynamic loads. | |
| **Content** | | |
| Introduction, degrees of freedom, response of single degree of freedom system, Laplace transform, harmonic excitation virtual work, Lagrange equation, multiple degree of freedom, undamped modes and frequencies; Static aeroelasticity, divergence of wind tunnel models, wall-sting and strut-mounted models, control reversal, classical flutter analysis, one and two-degree of freedom flutter, flutter boundary characteristics. | | |

**Elective : C: Aircraft propulsion**

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|---|---|---|
| **Subject Code:** | | **Course Title: Aircraft Propulsion** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the Aircraft Propulsion course for B.Tech. students specializing in Aerospace Engineering is to provide a comprehensive understanding of the principles and technologies involved in aircraft propulsion systems. This includes an exploration of various propulsion methods, performance analysis, and the integration of these systems within the broader context of aerospace design and operation. | |
| **Content** | | |
| Turbojets; Axial Compressor and its performance; Elementary Theory of Turbines; Injectors and Fuel Injection, Combustion Chamber performance; Design Procedure. Books: J D Mattingly, Elements of Gas Turbine Propulsion, McGraw-HillJ D Mattingly, W H Heiser, D H Daley, Aircraft Engine Design, AIAAS L Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery, Pergamon Press H Cohen, G F C Rogers, and H Saravanamutto, Gas Turbine Theory, Longman. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: New propulsion systems** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim for the topic of new propulsion systems for B.Tech. students specializing in Aerospace Engineering is to explore innovative technologies and methodologies that enhance propulsion efficiency and performance. This subject will provide students with a comprehensive understanding of the principles governing advanced propulsion systems, including their design, analysis, and application in modern aerospace vehicles. | |
| **Content** | | |
| Ramjets and scramjets, ram rockets, space planes, Classification and performance analysis of nuclear fission and fusion rockets. Plasma rockets, Electrostatic thrusters, MHD propulsion, laser rockets, solar thermal rockets, solar sail, other advanced propulsion concepts. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Principles of combustion and emission** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Principles of Combustion and Emission is to provide B.Tech. students specializing in Aerospace with a comprehensive understanding of the fundamental concepts related to combustion processes and their associated emissions. This curriculum is designed to equip students with the necessary knowledge to analyze and optimize combustion systems, ensuring efficiency and environmental compliance. | |
| **Content** | | |
| Introductory concepts. Thermodynamics of reacting systems: conservation of mass and energy in a chemical reaction, adiabatic flame temperature, second law aspects of chemical reactions. Essentials of chemical Kinetics: molarity and order of chemical reaction, general equation for rate of reaction, equation of Arrhenius, activation energy. Theories of premixed laminar and turbulent flames; concepts of ignition, flame stabilization, extinction and quenching. Theories of gaseous diffusion flames; droplet and spray combustion: theories of atomization, spray combustion models, spray combustion characteristics and design of burners; mechanism and kinetics of coal combustion; fluidized bed combustion; flames related to industrial applications; Emissions from combustion: constituents and types of emission, mechanisms of hydrocarbon and particulate emissions, theories of soot and NOx formation. Control of emissions. | | |

**Elective : D: Flight mechanics & automatic control**

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|---|---|---|
| **Subject Code:** | | **Course Title: Automatic control of aircraft** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Automatic Control of Aircraft is to provide B.Tech. students specializing in Aerospace Engineering with a comprehensive understanding of the principles and applications of control systems in aviation. This subject will cover the fundamental concepts necessary for the design and analysis of automatic control systems used in aircraft. | |
| **Content** | | |
| System, open loop and closed loop control, typical objectives of control analysis of linear invariant systems: governing equations, input-output approach, free and forced-responses, impulse response, frequency response, transfer function and its graphical representation, Role of transfer function in stability, transient and forced responses, block diagram algebra and signal flow graph; Analysis of feedback control system; common control objectives, typical system layout, classical stability and error analysis; Modern approach using state variables; design of control systems: classical approach root locus and bode plot, modern approach regulator problem. Introduction to sampled data and digital systems analysis: general configuration and models, free and forced responses; dynamics of sensors and actuators used in aerospace systems, Longitudinal and lateral stability augmentation and autopilot systems, Automatic landing system. | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Drone and unmanned aircraft technology** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Drone and Unmanned Aircraft Technology is to provide B.Tech. (Aerospace) students with a comprehensive understanding of the principles and applications of these advanced technologies. This curriculum is designed to equip students with the necessary skills and knowledge to innovate and excel in the rapidly evolving field of unmanned aerial systems. | |
| **Content** | | |
| Introduction to Unmanned Aerial Vehicles (UAVs), types of UAVs, applications, design process and design goals :<br>• Unmanned Aerial Systems: description of each sub-system and their roles<br>• Mission specific configuration selection, powerplant selection and preliminary design<br>• Aerodynamics and Performance, equation of motion and dynamics model<br>• Levels of autonomy, autopilot architecture and design, stability and control analysis, linear control design, gain selection through experimentation, nonlinear control design, state estimation, sensor, actuator, telemetry<br>• Commercial-Off-The-Shelf (COTS) design and system integration<br>• Ground station, Microcontroller programming using Real Time Operating System (RTOS), Hardware-in-the-loop simulation (HILS), experimental procedures and flight testing<br>• Case studies: coaxial helicopter, quadrotor, fixed wing, conventional helicopter, innovative new concepts | | |

References :

1. Castillo, P., Lozano, R., and Dzul, A. E., Modelling and Control of Mini-Flying Machines, Springer, London, 2005.
2. Beard, R., and McLain, T., Small Unmanned Aircraft: Theory and Practice, Princeton University Press, 2012.
3. Mettler, B., Identification Modeling and Characteristics of Miniature Rotorcraft, Springer, 2003.
4. Shkarayev, S. V., Ifju, P. G., Kellogg, J. C., and Mueller, T. J., Introduction to the Design of Fixed-Wing Micro Air Vehicles Including Three Case Studies, AIAA Education Series, 2007.
5. Appriou, A., Aerial Robotics, Journal Aerospace Lab, Issue 8, December 2014.
6. Prouty, R. W., Helicopter Performance, Stability, and Control, Krieger Publishing Company, Florida, 1986.

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|---|---|---|
| **Subject Code:** | | **Course Title: Helicopter engineering** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the Helicopter Engineering course for B.Tech. students specializing in Aerospace is to provide a comprehensive understanding of the design, operation, and maintenance of helicopter systems. This curriculum is designed to equip students with the necessary theoretical knowledge and practical skills essential for a successful career in the aerospace industry. | |
| **Content** | | |
| Introduction, Differences with fixed wing aircraft, Helicopter components and performance requirements, Introduction to hovering theory, Hovering and vertical flight performance analysis. Autorotation in vertical descent, physical concepts of blade motion and rotor control aerodynamics of forward flight, forward flight performance, tail rotor, Helicopter force, momentum and power equilibrium, Control of helicopter, Introduction to helicopter vibration problems. | | |

| **Subject Code:** | | **Course Title: Flight Laboratory (in collaboration with IIT Kanpur)** |
|---|---|---|
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the Flight Laboratory course for B.Tech. students specializing in Aerospace Engineering is to provide a comprehensive understanding of flight dynamics and aircraft performance. This course is designed to equip students with practical skills and theoretical knowledge essential for analyzing and conducting experiments related to flight. | |
| **Content** | | |
| Introduction to flight testing and instrumentation 1. Techniques and data reduction methods, Error analysis 2. Calibration of flight and special flight test instruments: Evaluation of cruise and climb performance of a small airplane. Determination of static and maneuver stability and control characteristics. Observations of airplane dynamic modes and stall characteristics: Introduction to flight testing and instrumentation. Techniques and data reduction methods, Error analysis. Calibration of flight and special flight test instruments. Evaluation of cruise and climb performance of a small airplane. Determination of static and maneuver stability and control characteristics. Observations of airplane dynamic modes and stall characteristics. | | |

**Elective: E : Humanities & social sciences**

| **Subject Code:** | | **Course Title: Values & Ethics** |
|---|---|---|
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the Values and Ethics course for B.Tech. (Aerospace) students is to instill a strong foundation in ethical principles and values relevant to the aerospace industry. This course seeks to enhance students' understanding of the moral implications of their work and the importance of integrity in engineering practices. | |
| **Content** | | |
| Practical ethics as a way of resolving moral conflict and of understanding professional responsibility in a multiculturally diverse society without devaluating specific viewpoints of ethical or metaphysical theory, ideology, or religion. Students will use proposals, value judgments, observation statements, assumptions, and alternate-world assumptions in arguing contemporary issues of moral importance. With this basic moral logic, students will resolve issues in terms of rights, responsibilities, and the community of rational beings in terms of consequences and contingencies and in terms of habituated virtues and character. Free and unrestricted discourse will be encouraged to let students find common ground in diversity. | | |

| **Subject Code:** | | **Course Title: Economics of airlines operations** |
|---|---|---|
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on the Economics of Airline Operations is to provide B.Tech. students specializing in Aerospace with a comprehensive understanding of the financial and economic principles that govern the airline industry. This curriculum will equip students with the analytical skills necessary to assess the economic factors influencing airline performance and decision-making. | |
| **Content** | | |
| The laws of SUPPLY and DEMAND in Airline Industry<br>S-Curve for Airline<br>Airline new entrants and exits<br>Globalization effects in domestic airline growth<br>Teleconferencing and other telecommunications technological advances effects on market share for air travel;<br>The commoditization of air travel effects on airlines<br>Results of recession, war, terrorism, or health concerns (e.g., SARS) on Airline Industry<br>Demand for Air Freight Transport<br>The relationship between COST and PRICE<br>Various types of major Costs of Airline<br>Major Taxes in the Airline Industry<br>Low Cost Airline vis-à-vis Regular airlines operation economics<br>Prices of Airline Tickets in various categories of airline | | |

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|---|---|---|
| **Subject Code:** | | **Course Title: Introduction to Psychology** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course "Introduction to Psychology" is to provide B.Tech. students specializing in Aerospace with a foundational understanding of psychological principles and theories. This course will explore various aspects of human behavior, cognition, and emotion, emphasizing their relevance to the field of aerospace engineering. | |
| **Content** | | |
| An introduction to the field of Psychology, primarily a survey of the individual, group, and organizational factors affecting human behavior and mental processes. The course explores the breadth of psychology as a scientific discipline and primary research and practice areas within major psychology specializations. Emphasis is placed on the application of basic principles of psychology to aviation, engineering, and other STEM disciplines. | | |

**Elective : F: Miscellaneous topics :**

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|---|---|---|
| **Subject Code:** | | **Course Title: Soft computing, Artificial Intelligence & Machine Learning** |
| **Contact Hours** | **Lecture- 3 Tutorial-0 Practical-0 Credit-3** | |
| **Objectives** | The aim of the course on Soft Computing, Artificial Intelligence, and Machine Learning is to equip B.Tech. students specializing in Aerospace with essential knowledge and skills. This curriculum is designed to enhance their understanding of advanced computational techniques and their applications in the aerospace sector. | |
| **Content** | | |
| Genetic Algorithms: introduction, mathematical foundation, computer implementation, genetic based machine learning, applications. Neural Networks: introduction, multi-layer networks, recurrent networks, learning paradigms. Fuzzy Control: an industrial perspective, knowledge based system for process control, mathematics of fuzzy control, nonlinear and adaptive fuzzy control. Chaos: complexity and simplicity, evolution of possibilities, simple models of chaos, strange attractors, deterministic chaos, self-organisation, synergetics. Evolutionary Computing: hybrid intelligent system, evolutionary dynamics, evolutionary engineering and its application. p-component (Manufacturing software lab): Development of software for the control of network based distributed and real time systems using techniques based on Corba, Java and XML etc. Development of software for collaboration using agents and other approaches. Development of process control software using neural network, fuzzy logic, genetics and other emerging approaches. | | |