VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

(Permanently Affiliated to JNTUH, Approved by AICTE, New Delhi and Accredited by NBA)

Shamshabad – 501 218, Hyderabad

BACHELOR OF TECHNOLOGY
AERONAUTICAL ENGINEERING

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI UNDER AUTONOMOUS STATUS FOR THE BATCHES ADMITTED FROM THE ACADEMIC YEAR 2011 - 12

B.Tech. Regular Four Year Degree Programme (For the batches admitted from the academic year 2011–12) & B.Tech. (Lateral Entry Scheme) (For the batches admitted from the academic year 2012 - 13)

Note: The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

- "Autonomous Institute / College" means an institute / college designated as autonomous institute / college by the Jawaharlal Nehru Technological University, Hyderabad (JNTUH), as per the JNTUH Autonomous College Statutes, 2011.

- "Academic Autonomy" means freedom to a College in all aspects of conducting its academic programs, granted by the University for promoting excellence.

- "Commission" means University Grants Commission.

- "AICTE" means All India Council for Technical Education.

- "University" the Jawaharlal Nehru Technological University, Hyderabad.

- "College" means Vardhaman College of Engineering, Hyderabad unless indicated otherwise by the context.

- "Program" means:
  Bachelor of Technology (B.Tech) degree program
  UG Degree Program: B.Tech

- "Branch" means specialization in a program like B.Tech degree program in Civil Engineering, B.Tech degree program in Computer Science and Engineering etc.

- "Course" or "Subject" means a theory or practical subject, identified by its course – number and course-title, which is normally studied in a semester. For example, ABS11T01: Mathematics - I, ACS11T02: Data Structures through C, etc.

- T – Tutorial, P – Practical, D – Drawing, L - Theory, C - Credits

FOREWORD

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

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

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

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

PRINCIPAL

VARDHAMAN COLLEGE OF ENGINEERING

(Autonomous)

(Permanent Affiliation with JNTUH, Approved by AICTE, New Delhi and Accredited by NBA)

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Programme
(for the batches admitted from the academic year 2011 - 12)
&
B.Tech. (Lateral Entry Scheme)
(for the batches admitted from the academic year 2012 - 13)

For pursuing four year undergraduate Bachelor Degree programme of study in Engineering (B.Tech) offered by Vardhaman College of Engineering under Autonomous status and herein after referred to as VCE:

1. APPLICABILITY

All the rules specified herein, approved by the Academic Council, will be in force and applicable to students admitted from the academic year 2011-2012 onwards. Any reference to "College" in these rules and regulations stands for Vardhaman College of Engineering.

2. EXTENT

All the rules and regulations, specified herein after shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies Principal, Vardhaman College of Engineering shall be the Chairman, Academic Council.

3. ADMISSION

3.1. Admission into first year of four year B.Tech degree programme of study in engineering:

3.1.1. Eligibility:

A candidate seeking admission into the first year of four year B.Tech degree programme should have

(i) Passed either Intermediate Public Examination (I.P.E) conducted by the Board of Intermediate Education, Andhra Pradesh, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Andhra Pradesh or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Andhra Pradesh or equivalent Diploma recognized by Board of Technical Education for admission as per the guidelines of APSCHE.

(ii) Secured a rank in the EAMCET examination conducted by A.P. State Council for Higher Education for allotment of a seat by the Convener, EAMCET, for admission.

3.1.2. Admission Procedure:

Admissions are made into the first year of four year B.Tech. Degree programme as per the stipulations of A.P State Council of Higher Education (APSCHE), Government of Andhra Pradesh.

(a) Category A seats are filled by the Convener, EAMCET.

(b) Category B seats are filled by the Management.

3.2. Admission into the second year of four year B.Tech degree programme in engineering

3.2.1. Eligibility:
A candidate seeking admission under lateral entry into the III semester B.Tech degree Programme should have passed the qualifying exam (B.Sc. Mathematics & Diploma holders), based on the rank secured by the candidate at Engineering Common Entrance Test ECET (FDH) in accordance with the instructions received from the Convener, ECET and Government of Andhra Pradesh.

3.2.2. Admission Procedure:
Admissions are made into the III semester of four year B.Tech degree programme through Convener, ECET (FDH) against the sanctioned strength in each programme of study as lateral entry students.

4. PROGRAMS OFFERED

Vardhaman College of Engineering, an autonomous college affiliated to JNTUH, offers the following B.Tech programmes of study leading to the award of B.Tech degree under the autonomous scheme.

1) B.Tech (Aeronautical Engineering)
2) B.Tech (Civil Engineering)
3) B.Tech (Computer Science & Engineering)
4) B.Tech (Electrical & Electronics Engineering)
5) B.Tech (Electronics & Communication Engineering)
6) B.Tech (Information Technology)
7) B.Tech (Mechanical Engineering)

5. DURATION OF THE PROGRAMS

5.1 Normal Duration

5.1.1 B.Tech degree program extends over a period of four academic years leading to the Degree of Bachelor of Technology (B.Tech) of the Jawaharlal Nehru Technology University, Hyderabad.

5.1.2 For students admitted under lateral entry scheme, B.Tech degree program extends over a period of three academic years leading to the Degree of Bachelor of Technology (B.Tech) of the Jawaharlal Nehru Technology University, Hyderabad.

5.2 Maximum Duration

5.2.1 The maximum period within which a student must complete a full-time academic program is 8 years for B.Tech. If a student fails to complete the academic program within the maximum duration as specified above, he / she will be required to withdraw from the program.

5.2.2 For students admitted under lateral entry scheme in B.Tech degree program, the maximum period within which a student must complete a full-time academic program is 6 years. If a student fails to complete the academic program within the maximum duration as specified above, he / she will be required to withdraw from the program.

5.2.3 The period is reckoned from the academic year in which the student is admitted first time in to the degree programme.

6. SEMESTER STRUCTURE

The College shall follow semester pattern. An academic year shall consist of a first semester and a second semester and the summer term follows in sequence. Each semester shall be of 23 weeks duration and this period includes time for course work, examination preparation, and conduct of examinations. Each semester shall have a minimum of 90 working days. The academic calendar is shown in Table 1 is declared at the start of the semester.

The first and second semesters shall have the duration to accommodate a minimum of 17 instructional weeks per semester.

Table 1: Academic Calendar

FIRST SEMESTER (23 weeks)	I Spell Instruction Period	: 9 weeks	19 weeks
	I Mid Examinations	: 1 week	
	II Spell Instruction Period	: 8 weeks	
	II Mid Examinations	: 1 Week	
	Preparation & Practical Examinations		2 weeks
	External Examinations		2 weeks
Semester Break			2 weeks
SECOND SEMESTER (23 weeks)	I Spell Instruction Period	: 9 weeks	19 weeks
	I Mid Examinations	: 1 week	
	II Spell Instruction Period	: 8 weeks	
	II Mid Examinations	: 1 Week	
	Preparation & Practical Examinations		2 weeks
	External Examinations		2 weeks
Summer Vacation			4 weeks

7. COURSE STRUCTURE

Every programme of study shall be designed to have 42 - 45 theory courses and 14 - 16 laboratory courses.

The Programme of instruction consists of:

(i) A general core programme comprising Basic Sciences, Mathematics, Basic Engineering, Humanities, Social Sciences and Management.

(ii) An Engineering Core programme imparting to the student the fundamentals of engineering in the branch concerned.

(iii) An elective programme enabling the students to take up a group of departmental and interdepartmental courses of interest to him / her.

In addition, a student has to carry out a mini project, project work, technical seminar and comprehensive viva.

Every course of the B Tech programme will be placed in one of the ten groups of courses with minimum credits as listed in the Table 2.

Note: All components prescribed in the curriculum of any programme of study shall be conducted and evaluated.

Contact Periods: Depending on the complexity and volume of the course the number of contact periods per week will be assigned.

Table 2: Group of Courses

S. NO	GROUP OF COURSES	CATEGORY	MINIMUM CREDITS
1	Humanities, Social Sciences and Management	HS	18
2	Basic Sciences	BS	30
3	Basic Engineering	BE	26
4	Core Engineering	CE	114
5	Professional Elective	PE	12
6	Inter Departmental Elective	IE	04
7	Mini Project	MP	02
8	Technical Seminar	TS	02
9	Comprehensive Viva	CV	02
10	Project Work	PW	10
TOTAL			**220**

8. CREDIT BASED SYSTEM

All the academic programs under autonomy are based on credit system. Credits are assigned based on the following norms:

8.1. The duration of each semester will normally be 23 weeks with 6 days a week (the second and fourth Saturdays will be observed as holidays in a month). A working day shall have 6 periods each of 60 minutes duration.

Each course is normally assigned a certain number of credits as follows:

- 1 credit per lecture / tutorial period per week.
- 2 credits for three (or more) period hours of practicals.
- 2 credits for mini project.
- 2 credits for technical seminar with 6 periods per week.
- 2 credits for comprehensive viva examination.
- 10 credits for project work with 12 periods per week.

8.2. The four year curriculum of any B.Tech programme of study shall have total of 220 credits. The exact requirements of credits for each course will be as recommended by the Board of Studies concerned and approved by the Academic Council.

In the case of lateral entry students, B.Tech programme for III, IV, V, VI VII and VIII semesters of study shall have a total 168 credits.

8.3. For courses like mini project / project work / technical seminar / comprehensive viva, where formal contact hours are not specified, credits are assigned based on the complexity of the work to be carried out.

9. METHOD OF EVALUATION

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks each for theory and 75 marks for practical / computer aided engineering drawing lab. In addition, mini-project, technical seminar, comprehensive viva and project work shall be evaluated for 50, 50, 50 and 200 marks respectively.

9.1 THEORY

For all lecture based theory courses, the evaluation shall be for 25 marks through internal evaluation and 75 marks through external end semester examination of three hours duration.

9.1.1. Internal evaluation

The 25 internal marks are divided as shown in Table 3:

Table 3: Internal marks distribution

Subjective Type Test	20 marks
Assignment / Tutorial	05 marks

For theory subjects, during the semester there shall be 2 midterm examinations. Each midterm examination consists of subjective test. The subjective test is for 20 marks, with duration of 2 hours. Subjective test of each semester shall contain 5 one mark compulsory questions in part-A and part-B contains 5 questions, the student has to answer 3 questions, each carrying 5 marks.

First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.

The internal marks shall be computed as the average of the two internal evaluations, of two subjective tests.

Five marks are earmarked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.

9.1.2. External Evaluation

The question paper shall be set externally and valued both internally and externally. The external end semester examination question paper in theory subjects will be for a maximum of 75 marks to be answered in three hours duration. There shall be two questions of descriptive type from each unit with internal choice. Each question carries 15 marks. Each theory course shall consist of five units of syllabus.

9.2 PRACTICALS

Practicals shall be evaluated for 75 marks, out of which 50 marks are for external examination and 25 marks are for internal evaluation. The 25 internal marks are distributed as 15 marks for day-to-day work and 10 marks for internal examination. The external end - examination shall be conducted by the teacher concerned and an external examiner from outside the college.

12 out of 14 to 16 experiments / exercises recommended are to be completed in a semester.

9.3. For Engineering Drawing, Advanced Engineering Drawing and Machine Drawing the distribution shall be 25 marks for internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for end examination. There shall be two internal evaluations in a semester and the average of the two internal evaluations is considered for the award of marks for internal marks.

9.4. The Computer Aided Engineering Drawing Lab, Computer Aided Aircraft Engineering Drawing Lab wherever offered is to be treated as a practical subject. Evaluation method adopted for practical subjects shall be followed here as well.

9.3 Mini Project

The mini project in an industry shall be carried out during the summer break for a minimum of 4 weeks after the VI Semester and completed before the start of the VII semester. A report has to be submitted for assessment to an internal evaluation committee comprising Head of the Department or his / her nominee and two faculty of the department including the project supervisor for 50 marks. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits. The mini project and its report shall be evaluated in VIII semester.

9.4 Technical Seminar

The seminar shall have two components, one chosen by the student from the course-work without repetition and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before an internal evaluation committee comprising the Head of the Department or his/her nominee, seminar supervisor and a senior faculty of the department. The two components of the seminar are distributed between two halves of the semester and are evaluated for 50 marks each. The average of the two components shall be taken as the final score. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

9.5 Comprehensive Viva

The comprehensive Viva will be conducted by a committee comprising Head of the Department or his/her nominee, two senior faculty of the respective department and an external examiner from outside the college. This is aimed at assessing the student's understanding of various subjects studied during the entire program of 4 years. The comprehensive viva shall be evaluated for 50 marks at the end of VIII semester. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

9.6 Project Work

The project work shall be evaluated for 200 marks out of which 50 marks for internal evaluation and 150 marks for end-semester evaluation. The project work shall be spread over in VII semester and in VIII semester. The project work shall be somewhat innovative in nature, exploring the research bent of mind of the student. A project batch shall comprise of not more than four students.

At the end of VII semester, students should submit synopsis summarizing the work done in VII semester. The project is expected to be completed by the end of VIII semester.

In VIII semester a mid-course review is conducted by Head of the Department and the project supervisor on the progress for 25 marks. On completion of the project a second evaluation is conducted for award of internal marks of another 25 marks before the report is submitted making the total internal marks 50. The end semester examination shall be based on the report submitted and a viva-voce exam for 150 marks by committee comprising of the Head of the Department, project supervisor and an external examiner. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

10. ATTENDANCE REQUIREMENTS TO APPEAR FOR THE SEMESTER-END EXAMINATION

10.1. A student shall be eligible to appear for semester-end examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.

10.2. Condonation of shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

10.3. Shortage of attendance below 65% in aggregate shall in no case be condoned.

10.4. The shortage of attendance shall not be condoned more than twice during the entire course.

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

10.6. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the current semester. The student may seek readmission for the semester when offered next. He will not be allowed to register for the subjects of the semester while he is in detention. A student detained due to shortage of attendance, will have to repeat that semester when offered next.

10.7. A stipulated fee shall be payable towards condonation of shortage of attendance to the College.

10.8. Attendance may also be condoned as per the recommendations of academic council for those who participate in prestigious sports, co-curricular and extra-curricular activities provided as per the Govt. of AP norms in vogue.

11. EVALUATION

Following procedure governs the evaluation.

11.1. Marks for components evaluated internally by the faculty should be submitted to the Controller of Examinations one week before the commencement of the semester-end examinations. The marks for the internal evaluation components will be added to the external evaluation marks secured in the semester-end examinations, to arrive at total marks for any subject in that semester.

11.2. Performance in all the courses is tabulated course-wise and will be scrutinized by the Examination Committee and moderation is applied if needed, based on the recommendations of moderation committee and course-wise marks lists are finalized.

11.3. Student-wise tabulation is done and student-wise memorandum of marks is generated which is issued to the student.

12. PERSONAL VERIFICATION

Students shall be permitted for personal verification of the semester-end examination answer scripts within a stipulated period after payment of prescribed fee.

13. SUPPLEMENTARY EXAMINATION

Supplementary examinations for the odd semester shall be conducted with the regular examinations of even semester and vice versa, for those who appeared and failed in regular examinations. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

14. ACADEMIC REQUIREMENTS FOR PROMOTION / COMPLETION OF REGULAR B.TECH PROGRAMME OF STUDY

The following academic requirements have to be satisfied in addition to the attendance requirements for promotion / completion of regular B.Tech programme of study.

FOR STUDENTS ADMITTED INTO B.TECH. (REGULAR) PROGRAMME

i. A student shall be deemed to have satisfied the minimum academic requirements for each theory, practical, design, drawing subject or project, if he secures not less than 35% of marks in the

semester-end examination and a minimum of 40% of marks in the sum of the internal evaluation and semester - end examination taken together.

ii. In case of mini project, technical seminar and comprehensive viva a student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each of them if he/she secures not less than 40% of marks.

iii. In case of project work, a student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted if he/she secures not less than 40% of marks on the aggregate in the internal evaluation and external end-evaluation taken together.

iv. A student shall be promoted from IV semester to V semester of programme of study only if he fulfils the academic requirement of securing 40 credits from the examinations held up to end of III semester including supplementary examinations.

v. A student shall be promoted from VI semester to VII semester of programme of study only if he fulfils the academic requirements of securing 68 credits out of which all 52 from I and II semesters shell be completed, from the examinations held up to V semester including supplementary examinations.

vi. A student shall register for all the 220 credits and earn all the 220 credits. Marks obtained in all the 220 credits shall be considered for the award of the class based on aggregate of marks.

vii. A student who fails to earn 220 credits as indicated in the course structure within **eight** academic years from the year of their admission shall forfeit their seat in B.Tech programme and their admission stands cancelled.

viii. Students who are detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the course in earlier regulations (or) have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same (or) equivalent subjects as and when subjects are offered, and pursue the remaining course work with the academic regulations of the batch into which such students are readmitted. However, all such readmitted students shall earn all the credits of subjects they have pursued for completion of the course.

FOR LATERAL ENTRY STUDENTS (BATCHES ADMITTED FROM 2012–2013)

i. A student shall be deemed to have satisfied the minimum academic requirements for each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the semester-end examination and a minimum of 40% of marks in the sum total of the internal evaluation and semester-end examination taken together.

ii. In case of mini project, technical seminar and comprehensive viva a student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each of them if he/she secures not less than 40% of marks.

iii. In case of project work, a student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted if he/she secures not less than 40% of marks on the aggregate in the internal evaluation and external end-evaluation taken together.

iv. A student shall be promoted from VI semester to VII semester only if he fulfils the academic requirements of securing 42 credits from the examinations held up to V semester including supplementary examinations.

v. A student shall register for all 168 credits and earn all the 168 credits. Marks obtained in all 168 credits shall be considered for the award of the class based on aggregate of marks.

vi. A student who fails to earn 168 credits as indicated in the course structure within **six** academic years from the year of their admission shall forfeit their seat in B.Tech programme and their admission stands cancelled.

vii. Students who are detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the course in earlier regulations (or) have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same (or) equivalent subjects as and when subjects are offered, and pursue the remaining course work with the academic regulations of the batch into which such students are readmitted. However, all such readmitted students shall earn all the credits of subjects they have pursued for completion of the course.

15. TRANSITORY REGULATIONS

Students who are detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the course in earlier regulations (or) have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same (or) equivalent subjects as and when subjects are offered, and pursue the remaining course work with the academic regulations of the batch into which such students are readmitted. A regular student has to satisfy all the eligibility requirements within the maximum stipulated period of eight years, and a lateral entry student within six years, for the award of B.Tech Degree.

16. TRANSCRIPTS

After successful completion of the entire programme of study, a transcript containing performance of all academic years will be issued as a final record. Transcripts will also be issued, if required, after payment of requisite fee. Partial transcript will also be issued upto any point of study to a student on request, after payment of requisite fee.

17. AWARD OF DEGREE

The degree will be conferred and awarded by Jawaharlal Nehru Technological University, Hyderabad on the recommendations of the Chairman, Academic Council.

17.1. Eligibility: A student shall be eligible for the award of B.Tech. Degree, if he fulfills all the following conditions:

- Registered and successfully completed all the components prescribed in the programme of study to which he is admitted.
- Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of study within the stipulated time.
- Obtained not less than 40% of marks (minimum requirement for declaring as passed).
- Has no dues to the college, hostel, and library etc. and to any other amenities provided by the College.
- No disciplinary action is pending against him.

17.2. AWARD OF CLASS

Declaration of Class is based on percentage of marks to be secured.

After a student has satisfied the requirement prescribed for the completion of the programme and is eligible for the award of B.Tech. Degree he shall be placed in one of the following four classes Shown in Table 4:

Table 4: Declaration of Class is based on percentage of marks to be secured

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured for the 220 Credits.
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	
Fail	Below 40%	

Sometimes, it is necessary to provide equivalence of percentages and/or *Class* awarded with *Grade Point Average (GPA).* This shall be done by prescribing certain specific thresholds in averages for *Distinction, First Class and Second Class,* as in Table 5.

Table 5: Percentage Equivalence of *Grade Points* (For a 10-Point Scale)

Grade Point	Percentage of Marks / Class
4.75	40 (Pass Class)
5.25	45
5.75	50 (Second Class)
6.25	55
6.75	60 *(First Class)*
7.25	65
7.75	70 *(First Class with Distinction)*
8.25	75

18. ADDITIONAL ACADEMIC REGULATIONS

i. Courses like projects / mini projects / seminars can be repeated only by re-registering for all the components in that semester.

ii. When a student is absent for any examination (internal or external) he is treated as to have obtained absent in that component (course) and aggregate of marks is done accordingly.

iv. When a component is cancelled as a penalty, he is awarded zero marks in that component.

19. REGISTRATION

Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses in time.

20. TERMINATION FROM THE PROGRAM

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

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

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

21. CURRICULUM

21.1 For each program being offered by the Institute, a Board of Studies (BOS) is constituted in accordance with AICTE / UGC / JNTUH statutes.

21.2. The BOS for a program is completely responsible for designing the curriculum once in three years for that program.

22. WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the college / if any case of indiscipline / malpractice is pending against him, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

23. GRIEVANCES REDRESSAL COMMITTEE

"Grievance and Redressal Committee" (General) constituted by the principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters. The composition of the complaints cum redressal committee shall be:

Headed by Senior Faculty member
Heads of all departments
A senior lady staff member from each department (if available)

The committee constituted shall submit a report to the principal of the college, the penalty to be imposed. The Principal upon receipt of the report from the committee shall, after giving an opportunity of being heard to the person complained against, submit the case with the committee's recommendation to the Governing Body of the college. The Governing Body shall confirm with or without modification the penalty recommended after duly following the prescribed procedure.

24. MALPRACTICE PREVENTION COMMITTEE

A malpractice prevention committee shall be constituted to examine and punish the students who does malpractice / behaves indiscipline in examinations. The committee shall consist of:

Principal.
Subject expert of which the subject belongs to.
Head of the department of which the student belongs to.
The invigilator concerned.
In-charge Examination branch of the college.

The committee constituted shall conduct the meeting on the same day of examination or latest by next working day to the incidence and punish the student as per the guidelines prescribed by the J N T University, Hyderabad from time to time.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

25. AMENDMENTS TO REGULATIONS

The Academic Council of Vardhaman College of Engineering reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

26. STUDENTS' FEEDBACK

It is necessary for the Colleges to obtain feedback from students on their course work and various academic activities conducted. For this purpose, suitable feedback forms shall be devised by the College and the feedback obtained from the students regularly in confidence, by administering the feedback form in print or on-line in electronic form.

The feedback received from the students shall be discussed at various levels of decision making at the College and the changes/ improvements, if any, suggested shall be given due consideration for implementation.

27. GRADUATION DAY

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

The College shall institute Prizes and Awards to meritorious students, for being given away annually at the *Graduation Day.* This will greatly encourage the students to strive for excellence in their academic work.

28. AWARD OF A RANK UNDER AUTONOMOUS SCHEME

28.1. Merit Rank will be declared only for those students who have been directly admitted in VCE under Autonomous Regulations and complete the entire course in VCE only within the minimum possible prescribed time limit, i.e., 4 years for B.Tech, 3 years for B.Tech under lateral entry scheme.

28.2. A student shall be eligible for a merit rank at the time of award of degree in each branch of Bachelor of Technology, provided the student has passed all subjects prescribed for the particular degree program in first attempt only.

28.3. Academic performance will be the sole criteria for awarding the merit rank and will be based only on performance of the student from the first to the eighth semester of the course.

28.4. The number of Merit Ranks to be announced for any course / program / branch / specialisation will be as follows:

- **3** (Three) Merit Ranks if the AICTE sanctioned intake is less than or up to 60.
- **4** (Four) Merit Ranks if the AICTE sanctioned intake is greater than 60.
- **5** (Five) Merit Ranks if the AICTE sanctioned intake is greater than 120.

28.5. Award of prizes, scholarships, or any other Honours shall be based on the rank secured by a candidate, consistent with the guidelines of the Donor, wherever applicable.

29. CONDUCT AND DISCIPLINE

29.1 Each student shall conduct himself / herself in a manner befitting his / her association with VCE.

29.2 He / she is expected not to indulge in any activity, which is likely to bring disrepute to the college.

29.3 He / she should show due respect and courtesy to the teachers, administrators, officers and employees of the college and maintain cordial relationships with fellow students.

29.4 Lack of courtesy and decorum unbecoming of a student (both inside and outside the college), wilful damage or removal of Institute's property or belongings of fellow students, disturbing others in their studies, adoption of unfair means during examinations, breach of rules and regulations of the Institute, noisy and unruly behaviour and similar other undesirable activities shall constitute violation of code of conduct for the student.

29.5 **Ragging in any form is strictly prohibited and is considered a serious offence. It will lead to the expulsion of the offender from the college.**

29.6 Violation of code of conduct shall invite disciplinary action which may include punishment such as reprimand, disciplinary probation, debarring from the examination, withdrawal of placement services, withholding of grades / degrees, cancellation of registration, etc., and even expulsion from the college.

29.7 Principal, based on the reports of the warden of Institute hostel, can reprimand, impose fine or take any other suitable measures against an inmate who violates either the code of conduct or rules and regulations pertaining to college hostel.

29.8 A student may be denied the award of degree / certificate even though he / she has satisfactorily completed all the academic requirements if the student is found guilty of offences warranting such an action.

29.9 Attendance is not given to the student during the suspension period.

30. OTHER ISSUES

The quality and standard of engineering professionals are closely linked with the level of the technical education system. As it is now recognized that these features are essential to develop the intellectual skills and knowledge of these professionals for being able to contribute to the society through productive and satisfying careers as *innovators, decision makers and/or leaders* in the global economy of the 21st century, it becomes necessary that certain improvements are introduced at different stages of their education system. These include:

a. Selective admission of students to a programme, so that merit and aptitude for the chosen technical branch or specialization are given due consideration.

b. Faculty recruitment and orientation, so that qualified teachers trained in good teaching methods, technical leadership and students' motivation are available.

c. Instructional/Laboratory facilities and related physical infrastructure, so that they are adequate and are at the contemporary level.

d. Access to good library resources and Information & Communication Technology **(ICT)** facilities, to develop the student's *mind* effectively.

These requirements make it necessary for the College to introduce improvements like:

a. Teaching-learning process on modern lines, to provide *Add-On* Courses for *audit*/credit in a number of peripheral areas useful for students' self development.

b. Life-long learning opportunities for faculty, students and alumni, to facilitate their dynamic interaction with the society, industries and the world of work.

c. Generous use of ICT and other modern technologies in everyday activities.

31. GENERAL

Where the words "he", "him", "his", "himself" occur in the regulations, they include "she", "her", "herself".

Note: Failure to read and understand the regulations is not an excuse.

COURSE STRUCTURE

B. TECH - AERONAUTICAL ENGINEERING

REGULATIONS: VCE-11

I SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1001	Mathematics-I	BS	3	1	-	4	25	75	100
A1002	Engineering Physics	BS	4	-	-	4	25	75	100
A1003	Engineering Chemistry	BS	4	-	-	4	25	75	100
A1005	Probability, Statistics and Computational Techniques	BS	3	1	-	4	25	75	100
A1301	Engineering Mechanics	BE	4	-	-	4	25	75	100
A1010	Engineering Physics and Engineering Chemistry Lab	BS	-	-	3	2	25	50	75
A1302	Engineering Workshop	BE	-	-	3	2	25	50	75
A1303	Engineering Drawing	BE	-	2	3	2	25	75	100
TOTAL			**18**	**04**	**09**	**26**	**200**	**550**	**750**

II SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1008	Technical English	HS	4	-	-	4	25	75	100
A1007	Mathematics-II	BS	3	1	-	4	25	75	100
A1004	Environmental Science	BS	4	-	-	4	25	75	100
A1501	Computer Programming	BE	4	-	-	4	25	75	100
A1202	Basic Electrical and Electronics Engineering	BE	3	1	-	4	25	75	100
A1009	English Language Communication Skills Lab	HS	-	-	3	2	25	50	75
A1502	Computer Programming Lab	BE	-	-	3	2	25	50	75
A1304	Advanced Engineering Drawing	BE	-	2	3	2	25	75	100
TOTAL			**18**	**04**	**09**	**26**	**200**	**550**	**750**

III SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1012	Mathematics for Aerospace Engineers	BS	4	-	-	4	25	75	100
A1013	Managerial Economics and Financial Analysis	HS	4	-	-	4	25	75	100
A1701	Introduction to Aircraft Industry	CE	4	-	-	4	25	75	100
A1306	Mechanics of Solids	CE	3	1	-	4	25	75	100
A1307	Mechanics of Fluids	CE	3	1	-	4	25	75	100
A1308	Thermodynamics	CE	3	1	-	4	25	75	100
A1702	Mechanics of solids Lab	BE	-	-	3	2	25	50	75
A1703	Mechanics of Fluids Lab	CE	-	-	3	2	25	50	75
TOTAL			**21**	**03**	**06**	**28**	**200**	**550**	**750**

B. TECH - AERONAUTICAL ENGINEERING

REGULATIONS: VCE-11

IV SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1215	Electrical Technology	BE	4	-	-	4	25	75	100
A1704	Aerodynamics-I	CE	4	-	-	4	25	75	100
A1705	Aircraft Production Technology	CE	4	-	-	4	25	75	100
A1706	Aerospace Vehicle Structures-I	CE	3	1	-	4	25	75	100
A1707	Flight Mechanics-I	CE	3	1	-	4	25	75	100
A1708	Mechanisms and Mechanical Design	CE	3	1	-	4	25	75	100
A1709	Computer Aided Aircraft Engineering Drawing Lab	CE	-	-	3	2	25	50	75
A1216	Electrical and Electronics Engineering Lab	CE	-	-	3	2	25	50	75
TOTAL			**21**	**03**	**06**	**28**	**200**	**550**	**750**

V SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1710	Air Transportation Systems	CE	4	-	-	4	25	75	100
A1711	Aerospace Propulsion - I	CE	4	-	-	4	25	75	100
A1712	Aerodynamics - II	CE	3	1	-	4	25	75	100
A1713	Flight mechanics - II	CE	3	1	-	4	25	75	100
A1714	Aerospace Vehicle Structures - II	CE	3	1	-	4	25	75	100
A1715	Introduction to Space Technology	CE	4	-	-	4	25	75	100
A1716	Aircraft Production Technology Lab	CE	-	-	3	2	25	50	75
A1717	Aerospace Vehicle Structures Lab	CE	-	-	3	2	25	50	75
TOTAL			**21**	**03**	**06**	**28**	**200**	**550**	**750**

VI SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1212	Control Systems	CE	3	1	-	4	25	75	100
A1330	Operations Research	HS	4	-	-	4	25	75	100
A1718	Aerospace Propulsion - II	CE	4	-	-	4	25	75	100
A1719	Flight Vehicle Design	CE	3	1	-	4	25	75	100
A1720	Finite Element Modeling and Analysis	CE	3	1	-	4	25	75	100
INTERDEPARTMENTAL ELECTIVE - I		HS	4	-	-	4	25	75	100
A1721	Flight Vehicle Design and Simulation Lab	CE	-	-	3	2	25	50	75
A1722	Aerodynamics and Propulsion Lab	CE	-	-	3	2	25	50	75
TOTAL			**21**	**03**	**06**	**28**	**200**	**550**	**750**

B. TECH - AERONAUTICAL ENGINEERING

REGULATIONS: VCE-11

VII SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1326	Heat Transfer	CE	4	-	-	4	25	75	100
A1723	Computational Fluid Dynamics	CE	4	-	-	4	25	75	100
A1724	Vibrations and structural Dynamics	CE	3	1	-	4	25	75	100
A1725	Avionics	CE	4	-	-	4	25	75	100
INTERDEPARTMENTAL ELECTIVE - II		IE	4	-	-	4	25	75	100
PROFESSIONAL ELECTIVE - I		PE	3	1	-	4	25	75	100
A1731	Computer Aided Aircraft Modeling and Assembly Lab	CE	-	-	3	2	25	50	75
A1732	Heat Transfer and CFD Lab	CE	-	-	3	2	25	50	75
A1733	Project Work (Stage - I)	PW	-	2	-	-	-	-	-
TOTAL			**22**	**04**	**06**	**28**	**200**	**550**	**750**

VIII SEMESTER

Code	Subject	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A1734	Aircraft systems and Instrumentation	CE	3	1	-	4	25	75	100
PROFESSIONAL ELECTIVE - II		PE	3	1	-	4	25	75	100
PROFESSIONAL ELECTIVE - III		PE	3	1	-	4	25	75	100
A1747	Computational Analysis of Aircraft Structures Lab	CE	-	-	6	2	25	50	75
A1748	Technical Seminar	TS	-	-	6	2	50	-	50
A1749	Comprehensive Viva	CV	-	-	-	2	-	75	75
A1750	Mini project	MP	-	-	-	2	50	-	50
A1733	Project Work (Stage - II)	PW	-	-	12	8	50	150	200
TOTAL			**09**	**03**	**24**	**28**	**250**	**500**	**750**

B. TECH - AERONAUTICAL ENGINEERING

REGULATIONS: VCE-11

ELECTIVES	
INTERDEPARTMENTAL ELECTIVE - I	
Code	**Subject**
A1148	Air Pollution and Control Methodologies
A1441	Satellite and Radar Communications
A1453	Digital Electronics and Microprocessors
A1331	CAD/CAM
A1337	Robotics
A1338	Composite Materials
INTERDEPARTMENTAL ELECTIVE – II	
A1016	Human Values and Ethics
A1017	Human Resource Management
A1018	Entrepreneurship
A1019	Business Communication
A1020	Intellectual Property and Patent Rights
A1021	Project Planning and Management
PROFESSIONAL ELECTIVE - I	
A1726	Space Mechanics
A1727	Aero Elasticity
A1728	Fatigue and Fracture Mechanics
A1344	Nano Technology
A1729	Boundary Layer Theory
A1730	Experimental Stress Analysis
PROFESSIONAL ELECTIVE - II	
A1735	Advanced Computational Fluid dynamics
A1736	Industrial Aerodynamics
A1737	Hypersonic Aerodynamics
A1738	Airport Management
A1739	Non destructive Testing
A1740	Theory of Plates and Shells
PROFESSIONAL ELECTIVE - III	
A1741	Rockets and Missiles
A1742	Propellant Technology
A1743	Helicopter Engineering
A1744	Design of Aircraft Structures
A1745	Hydraulics and Pneumatics Systems
A1746	Air Line Management

SYLLABI FOR I SEMESTER

B. Tech. AE I SEMESTER

MATHEMATICS - I
(Common to all Branches)

Course Code: **A1008**

L	T	P	C
3	1	-	4

UNIT - I

DIFFERENTIAL EQUATIONS OF FIRST ORDER AND THEIR APPLICATIONS: Overview of differential equations, exact, linear and Bernoulli. Applications to Newton's law of cooling, law of natural growth and decay and orthogonal trajectories.

UNIT - II

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS: Linear differential equations of second and higher order with constant coefficients, RHS term of the type Q(x)= e^{ax} , sinax, cosax, and x^n, $e^{ax}V(x)$, $x^nV(x)$, method of variation of parameters. Applications to electrical circuits, simple harmonic motion.

UNIT - III

FUNCTIONS OF SINGLE VARIABLE AND THEIR APPLICATIONS AND MULTIPLE INTEGRALS: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, generalized mean value theorem (all theorems without proof), functions of several variables, functional dependence, Jacobian - maxima and minima of functions of two variables with and without constraints. Radius, centre and circle of curvature – evolutes and envelopes. Multiple integrals, double and triple integrals, change of order of integration, change of variables

UNIT - IV

LAPLACE TRANSFORMS: Laplace transform of standard functions, inverse transform, first shifting theorem, transforms of derivatives and integrals, unit step function, second shifting theorem, Dirac's delta function, convolution theorem, periodic function, differentiation and integration of transforms, application of Laplace transforms to ordinary differential equations.

UNIT - V

VECTOR CALCULUS: Gradient, divergence, curl and their related properties, potential function, Laplacian and second order operators. Line integral, work done, surface integrals, flux of a vector valued function. Vector integrals theorems: Green's - Stoke's and Gauss's divergence theorems (statement & their verification).

TEXT BOOKS:

1. Grewal B.S (2007), *Higher Engineering Mathematics*, 40th Edition, Khanna Publishers, New Delhi.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), *Engineering Mathematics Vol - I*, 10th Revised Edition, S. Chand & Company Limited, New Delhi.

REFERENCE BOOKS:

1. Jain R. K, Iyengar S. R. K (2008), *Advanced Engineering Mathematics,* 3rd edition, Narosa Publication House, New Delhi.
2. Shahanaz Bathul (2007), *Engineering Mathematics-I*, 3rd Edition, Right Publishers, Hyderabad.
3. Ramana B.V (2010), *Engineering Mathematics*, Tata McGraw Hill Publishing Co. Limited, New Delhi.

B. Tech. AE I SEMESTER

ENGINEERING PHYSICS
(Common to ME, EEE, AE & CE)

Course Code: **A1002**

L	T	P	C
4	-	-	4

UNIT - I

BONDING IN SOLIDS: Ionic bond, Covalent bond, Metallic bond, Hydrogen bond, Vander-Waal's bond, calculation of cohesive energy.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURES: Space lattice, Unit cell lattice parameters, Crystal systems, Bravais lattices, Atomic radius, co-ordination number and packing factor of SC, BCC, FCC, diamond and HCP structures, structures of NaCl, ZnS, CsCl.

UNIT - II

CRYSTAL PLANES & X-RAY DIFFRACTION: Miller indices, Crystal planes and directions, Inter planar spacing of orthogonal crystal systems, Basic principles of X-ray diffraction, Bragg's law, Laue method, Powder method, applications of X- ray diffraction.

NANOTECHNOLOGY: Origin of Nanotechnology, Nano scale, surface to volume ratio, bottom-up fabrication: Sol-gel, precipitation, Combustion methods; Top-down fabrication: Chemical vapour deposition, physical vapour deposition, pulsed laser vapour deposition methods and applications.

UNIT - III

PRINCIPLES OF QUANTUM MECHANICS: Waves and particles, De Broglie hypothesis , matter waves, Davisson and Germer's experiment, g. P. Thomson experiment, Schrödinger's time independent wave equation, physical significance of the wave function - particle in one dimensional potential box.

BAND THEORY OF SOLIDS: Electron in a periodic potential, Bloch theorem, Kronig-penny model(qualitative treatment), origin of energy band formation in solids, classification of materials into conductors, semi conductors & insulators, concept of effective mass of an electron.

UNIT - IV

DIELECTRIC PROPERTIES: Electric dipole moment, dielectric constant, polarization, electric susceptibility internal fields in solids, Clausius - Mossotti equation and its derivation, Piezo-electricity and Ferro- electricity.

MAGNETIC PROPERTIES: Origin of magnetic moment, classification of magnetic materials on the basis of magnetic moment, domain theory of Ferro magnetism, hysteresis curve, soft and hard magnetic materials.

SUPERCONDUCTIVITY: Introduction to superconductivity, Meissner effect, BCS theory, applications of superconductors.

UNIT- V

LASERS: Characteristics of lasers, spontaneous and stimulated emission of radiation, meta-stable state, population inversion, lasing action, Einstein's coefficients, ruby laser, Helium-neon laser, semiconductor diode laser, applications of lasers.

FIBER OPTICS: Principle of optical fiber, acceptance angle, numerical aperture, types of optical fibers, attenuation of signal in optical fibers, application of optical fibers.

TEXT BOOKS:

1. S. O. Pillai, Sivakami (2009), *Engineering Physics,* 2nd edition, New Age International (P) Ltd, Delhi.

REFERENCE BOOKS:

1. C. Kittel (2009), *Introduction to Solid State Physics*, 8th edition, Wiley Eastern Publications, India.
2. A. J. Dekker (1999), *Solid State Physics*, Macmillan India Ltd, Chennai.
3. M. Ratner, D. Ratner (2003), *Nanotechnology*, Pearson Edition, India.
4. P. Sarah (2008), *Lasers & Optical Fiber communications*, IK International (P) Ltd, New Delhi.

B. Tech. AE I SEMESTER

ENGINEERING CHEMISTRY
(Common to ME, EEE, AE & CE)

Course Code: **A1003**

L	T	P	C
4	-	-	4

UNIT - I

ELECTROCHEMISTRY AND BATTERIES: Concept of Electrochemistry, Conductance Electrolyte in solution, Conductance specific, Equivalent and molar conductance, Ionic Mobilities, Kolrausch's law & applications. *EMF:* Galvanic cells, Nernst equation, Galvanic series, Numerical problems.

BATTERIES: Primary and secondary cells, Lead-acid cell, NI-CD cell, Lithium cells. Applications of batteries, *Fuel cells:* Hydrogen – Oxygen fuel cells, advantages of fuel cells.

UNIT - II

WATER: Introduction, *Hardness:* causes, expression of hardness units, types of hardness, estimation of temporary and permanent hardness of water, numerical problems. Softening of water internal and external treatment, Zeolite, ion exchange process and numerical problems, reverse osmosis, electro dialysis.

UNIT - III

POLYMERS: Types of polymerization, *Plastics:* Thermoplastic resins & thermo set resins. Compounding & fabrication of plastics, preparation, properties, engineering applications of: polyethylene, PVC, PS, Teflon, Nylon. *Rubber:* vulcanization. *Elastomers:* Buna-s, Buna-n, Thiokol rubbers, fibers polyester, applications.

SURFACE CHEMISTRY: Solid surfaces, types of adsorption, Longmuir adsorption isotherm, application adsorption, classification of colloids, electrical & optical properties of colloids, applications of colloids in industry. *Nano materials*: Introduction, preparation and applications of nano materials.

UNIT - IV

ENERGY SOURCES: Fuels, classification, conventional fuels (solid, liquid, gaseous) solid fuels, coal analysis proximate and ultimate analysis and their significance liquid fuels, primary petroleum, refining of petroleum. *Gaseous Fuels:* natural gas, analysis of flue gas by Orsat's method combustion, problems.

UNIT - V

PHASE RULE: Definitions, phase, component, degree of freedom and phase rule equation. Phase diagrams, one component system: Water system. Two component system: Lead silver system.

MATERIAL CHEMISTRY: *Cement:* Composition of Portland cement, manufacture of Port land cement. *Lubricants:* Criteria of a good lubricant. *Refractories:* Classification, characteristics of good refractory. *Insulators & conductors:* Classification of insulators, characteristics of thermal & electrical insulators and applications of superconductors.

TEXT BOOKS:

1. Dara S. S., Mukkanti (2006), *Engineering Chemistry,* S. Chand & Company Limited, New Delhi.

REFERENCE BOOKS:

1. Jain. P. C. and Monica Jain (2008), *Engineering Chemistry,* Dhanpat Rai Publishing Company, New Delhi.
2. Mishra. K. N., Mani R.P. and Rama Devi. B (2009), *Chemistry of Engineering Materials,* Cengage learning.
3. Kuriacase J. C and Rajaram. J (2004), *Engineering Chemistry,* Tata Mc Graw Hill Co., New Delhi.

B. Tech. AE I SEMESTER

PROBABILITY, STATISTICS AND COMPUTATIONAL TECHNIQUES
(Common to AE, CSE, IT & CE)

Course Code: A1005

L	T	P	C
3	1	-	4

UNIT - I

PROBABILITY, RANDOM VARIABLES AND DISTRIBUTIONS: Sample space and events – probability – the axioms of probability. Random variables – discrete distribution – continuous distribution– binomial distribution - poisson distribution -normal distribution – normal approximation to binomial distribution.

UNIT - II

TESTING OF HYPOTHESIS: Tests of hypothesis point estimations – interval estimations. Large samples - null hypothesis - alternative hypothesis type i & type ii errors – critical region, confidence interval for mean, difference between the means, single proportion and difference of proportions. Confidence interval for the t-distribution - tests of hypothesis - t-distributions, f-distribution and chi-square distribution.

UNIT - III

SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Bisection method – regular falsi method – iteration method - newton raphson method.

INTERPOLATION: Newton's forward interpolation – newton's backward interpolation – interpolation with unequal intervals –lagrange's interpolation – newton's divided difference interpolation. Derivatives using newton's forward formula – derivatives using newton's backward formula.

UNIT - IV

CURVE FITTING AND NUMERICAL INTEGRATION: Curve fitting: fitting a straight line – second degree curve - exponential curve - power curve by method of least squares. Numerical integration – newton cote's formula - trapezoidal rule – simpson's 1/3 rule – simpson's 3/8 rule.

UNIT - V

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Single step methods: Taylor's series method - euler's and modified euler's methods - fourth order runge-kutta method for solving first and second order equations- multistep methods: Milne's and adam's, predictor and corrector methods.

TEXT BOOKS:

1. Grewal B.S (2007), *Higher Engineering Mathematics*, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), *Probability and Statistics*, 3rd Revised Edition, New Delhi, S. Chand & Company Limited.

REFERENCE BOOKS:

1. Iyengar T. K. V., Krishna Gandhi B. & Others (2011), *Mathematical Methods*, 6th Revised Edition, New Delhi, S. Chand & Company Limited.
2. Bali N. P. and Narayana Iyengar N. Ch (2004), *A Textbook of Engineering Mathematics*, Sixth Edition, New Delhi, Laxmi Publications.
3. Sastry S. S (2005), *Introductory Methods of Numerical Analysis*, 4th Edition, New Delhi, PHI Learning Pvt. Ltd.

B. Tech. AE I SEMESTER

ENGINEERING MECHANICS
(Common to ME, AE & CE)

Course Code: **A1301**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION TO ENGINEERING MECHANICS: Basic concepts, systems of forces**:** coplanar concurrent forces - components in space – resultant – moment of force and its application – couples and resultant of force systems.

EQUILIBRIUM OF SYSTEMS OF FORCES: free body diagrams, equations of equilibrium of coplanar systems and spatial systems for concurrent forces.

UNIT - II

FRICTION: Types of Friction – Limiting Friction – Laws of Friction – angle of repose, equilibrium body laying on rough inclined plane – ladder friction - wedge friction.

UNIT - III

CENTROID AND CENTER OF GRAVITY: Centroids of lines – centroids of area - centroids of composite figures theorems of pappus - centre of gravity of bodies – centroids of volumes centre of gravity of composite bodies.

UNIT - IV

AREA MOMENTS OF INERTIA: Introduction definition of moment of inertia – polar moment of inertia, radius of gyration - transfer theorems for moment of inertia – moments of inertia by integration – movements of inertia of composite figures, products of inertia, transfer formula for product of inertia.

MASS MOMENT OF INERTIA: Introduction**,** moment of inertia of masses – radius of gyration - transfer formula for mass moments of inertia – mass moments of inertia by integration - mass moment of inertia of composite bodies.

UNIT - V

VIRTUAL WORK: Introduction – principle of virtual work – applications – beams, lifting machines, simple framed structures (ladder problems).

TEXT BOOKS:

1. Fedinand L. Singer (1998), *Engineering Mechanics*, Harper – Collins Publishers, New Delhi.
2. S. S. Bhavikatti, J. G. Rajasekharappa (2006), *Engineering Mechanics*, New Age International, India.

REFERENCES BOOKS:

1. Timoshenko & Young (2007), *Engineering Mechanics*, Mc Graw Hill, India.
2. A.R. Tayal (2009), *Engineering Mechanics*, Umesh Publications, New Delhi.
3. R.S. Khurmi (2009), *Engineering Mechanics*, S. Chand & Company Limited, New Delhi.
4. K.L Kumar (2009), *Engineering Mechanics*, Tata Mc Graw Hill, New Delhi.
5. Irving. H. Shames (1999), *Engineering Mechanics*, Prentice-Hall, India.

B. Tech. AE I SEMESTER

ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LAB
(Common to ME, EEE, AE & CE)

Course Code: **A1010**

L	T	P	C
-	-	3	2

ENGINEERING PHYSICS LAB

1. Study of I-V characteristics of an LED.
2. Determination of numerical aperture - optical Fibers.
3. Determination of time constant – R-C circuit.
4. Determination of energy gap of a given semiconductor material.
5. Determination of rigidity modulus of the material of a given wire– Torsional pendulum.
6. Determination of frequency of vibrating tuning fork – Melde's experiment.
7. Determination of wavelength and angular divergence of given laser source.
8. Determination of frequency of AC supply – Sonometer.
9. Determination of dispersive power of the material of the given prism – spectrometer.
10. Study of variation of magnetic field along a circular current carrying conductor – Stewart & Gee apparatus.

ENGINEERING CHEMISTRY LAB

1. **TITRIMETRY:** Estimation of hardness of water by EDTA method (or) Estimation of calcium in limestone by Permanganometry.
2. **MINERAL ANALYSIS:** Determination of percentage of copper in brass

INSTRUMENTAL METHODS:

3. **COLORIMETRY:** Determination of ferrous ion in cement by colorimetric method (Or) Estimation of copper by colorimetric method.
4. **CONDUCTOMETRY:** Conductometric titration of strong acid vs strong base (or) Conductometric titration of mixture of acids vs strong base.
5. **POTENTIOMETRY:** Titration of strong acid vs strong base by Potentiometry (or) Titration of weak acid vs strong base by Potentiometry.

PHYSICAL PROPERTIES:

6. Determination of viscosity of sample oil by redwood/ Ostwald's viscometer.
7. Determination surface tension of lubricants.
8. **IDENTIFICATION AND PREPARATIONS:** preparation of organic compounds: aspirin (or) Benzimidazole.

KINETICS:

9. To determine the rate constant of hydrolysis of methyl acetate Catalysed by an acid and also the energy of Activation (or) to study the kinetics of reaction between $K_2S_2O_8$ and KI.
10. **DEMONSTRATION EXPERIMENTS (ANY ONE OF THE FOLLOWING)**:
    a. Preparation of Thiokol rubber
    b. Adsorption on charcoal

B. Tech. AE I SEMESTER

ENGINEERING WORKSHOP
(Common to ME, AE & CE)

Course Code: **A1302**

L	T	P	C
-	-	3	2

1. TRADES FOR EXERCISES:

a. Carpentry
b. Fitting
c. House Wiring
d. Tin-Smithy
e. Foundry

2. DEMONSTRATION TRADES:

a. Black Smithy
b. Welding
c. Plumbing

TEXT BOOKS:

1. H. S. Bawa (2007), *Workshop Practice,* Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. A. Rajendra Prasad, P. M. M. S. Sarma (2002), *Workshop Practice*, Sree Sai Publication, New Delhi.

REFERENCE BOOKS:

1. K. Jeyachandran, S. Natarajan, S. Balasubramanian (2007), *A Primer on Engineering Practices Laboratory*, Anuradha Publications, New Delhi.
2. T. Jeyapoovan, M. Saravanapandian, S. Pranitha (2006), *Engineering Practices Lab Manual*, Vikas Publishing House Private Limited, New Delhi.

B. Tech. AE I SEMESTER

ENGINEERING DRAWING
(Common to ME, AE & CE)

Course Code: **A1303**

L	T	P	C
-	2	3	2

UNIT - I

INTRODUCTION TO ENGINEERING DRAWING: Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction.

SCALES: Different types of scales, plain scales, diagonal scales, comparative scales, vernier scales, scale of chords.

CURVES USED IN ENGINEERING PRACTICE AND THEIR CONSTRUCTIONS: Conic Sections, Special Curves and Involutes.

UNIT - II

DRAWING OF PROJECTIONS OR VIEWS ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY: Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to planes, true lengths, traces, application problems.

UNIT - III

PROJECTIONS OF PLANES AND SOLIDS: Projections of regular planes, inclined to both planes. Projections of regular solids inclined to both planes.

UNIT - IV

SECTIONS AND SECTIONAL VIEWS: Right regular solids – sections of prisms, cylinders, pyramids and cones.

UNIT - V

DEVELOPMENT OF SURFACES: Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

TEXT BOOKS:

1. N. D. Bhat (2006), *Engineering Drawing*, Charotar Publications, New Delhi.

REFERENCE BOOKS:

2. Venugopal (2010), *Engineering Drawing and Graphics*, 2nd edition, New Age Publications, New Delhi.
3. Johle (2009), *Engineering Drawing*, Tata Mc Graw Hill, New Delhi, India.
4. Trymbaka Murthy (2007), *Computer Aided Engineering Drawing*, I.K. International Publishers, New Delhi.
5. R.B. Choudary (2005), *Engineering graphics with Auto CAD*, Anuradha Publishers, New Delhi.

SYLLABI FOR II SEMESTER

B. Tech. AE II SEMESTER

TECHNICAL ENGLISH
(Common to ME, EEE, AE & CE)

Course Code: **A1008**

L	T	P	C
4	-	-	4

UNIT - I

1. ***Sir CV Raman: A Path breaker in the Saga of Indian Science*** from E*njoying Every Day English*
2. ***Mother Teresa*** from *Inspiring Speeches and Lives*

FOCUSING ON Word formation with prefixes and suffixes, synonyms and antonyms, noun phrases, infinitive and gerund, subject-verb agreement (concord), tenses, impersonal passive conditional sentences, adjectives and degrees of comparison, conjunctions and prepositions.

UNIT - II

1. ***The Connoisseur*** from E*njoying Every Day English*
2. ***Sam Pitroda*** from *Inspiring Speeches and Lives*

FOCUSING ON Word formation with prefixes and suffixes, synonyms and antonyms, noun phrases, infinitive and gerund, subject-verb agreement (concord), tenses, impersonal passive conditional sentences, adjectives and degrees of comparison, conjunctions and prepositions.

UNIT - III

1. ***Bubbling Well Road*** from E*njoying Every Day English*
2. ***I Have a Dream*** **- by Martin Luther King** from *Inspiring Speeches and Lives*

FOCUSING ON Word formation with prefixes and suffixes, synonyms and antonyms, noun phrases, infinitive and gerund, subject-verb agreement (concord), tenses, impersonal passive conditional sentences, adjectives and degrees of comparison, conjunctions and prepositions.

UNIT - IV

LETTERS, MEMOS AND E-MAIL: Letters, business letters, significance, structure and layout, principles, types and samples, claim letters, adjustment letters, sales letters, job application letters, memos, classification and purpose style, E-mails, E-mail etiquettes, sample E- mail messages, effectiveness and security.

UNIT - V

REPORTS: Objectives, characteristics of a report, types of reports, importance of reports, formats, rewriting structure of reports, writing the report, visual aids, revising, editing and proof reading, proof reading symbols.

TEXT BOOKS:

1. Ramakrishna Rao. A (2009), *Enjoying Every Day English,* Sangam Books, Hyderabad.
2. Yadava Raju. B and Muralikrishna. C (2009), *Inspiring Speeches and Lives,* Maruthi Publications, Guntur.
3. Meenakshi Raman, Sangeeta Sharma (2009), *Technical Communication,* Oxford University Press, New Delhi.

REFERENCE BOOKS:

1. Edgar Thorpe and Showick Thorpe (2008), Basic *Vocabulary for Competitive Examination,* Pearson Education, New Delhi, India.
2. Ashraf Rizvi M (2005), *Effective Technical Communication,* Tata Mc Graw Hill, New Delhi.
3. Raymond Murphy (2004), *Murphy's English Grammar with CD,* 3rd Edition, Cambridge University Press, USA.

B. Tech. AE II SEMESTER

MATHEMATICS - II
(Common to all Branches)

Course Code: **A1007**

L	T	P	C
3	1	-	4

UNIT - I

SOLUTION FOR LINEAR SYSTEMS AND EIGEN VALUES & EIGEN VECTORS: *Matrices and linear systems of equations*: Elementary row transformations - rank - echelon form, normal form, solution of linear systems, direct methods**.** Eigen values, Eigen vectors - properties. Cayley-Hamilton theorem (without proof) - inverse and powers of a matrix by Cayley-Hamilton theorem, diagonlization of matrix, calculation of powers of a matrix, modal and spectral matrices.

UNIT - II

LINEAR TRANSFORMATIONS: Real matrices, symmetric, skew symmetric, orthogonal, linear transformation, orthogonal transformation. *Complex matrices*: Hermitian, Skew Hermitian and unitary, Eigen values and Eigen vectors of complex matrices and their properties. Quadratic forms- reduction of quadratic form to canonical form -rank - positive, negative definite - semi definite - index - signature.

UNIT - III

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions - solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations. Method of separation of variables for second order equations -two dimensional wave equation.

UNIT - IV

FOURIER SERIES: Determination of Fourier coefficients, Fourier series, even and odd functions, Fourier series in an arbitrary interval, even and odd periodic continuation. Half-range Fourier sine and cosine expansions. Fourier integral theorem, Fourier sine and cosine integral.

UNIT - V

FOURIER TRANSFORMS AND Z - TRANSFORMS: Fourier transform, Fourier sine and cosine transforms, properties, inverse transforms, finite Fourier transforms. Z-transforms, inverse Z-transforms, properties, Damping rule, Shifting rule, initial and final value theorems, Convolution theorem, Solution of difference equations by Z-transforms.

TEXT BOOKS:

1. Grewal B. S (2007), *Higher Engineering Mathematics*, 40th edition, Khanna Publishers, New Delhi.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), *Mathematical Methods*, 10th revised edition, S. Chand & Company Limited, New Delhi.

REFERENCE BOOKS:

1. Shahanaz Bathul (2007), *Mathematical Methods*, 3rd edition, Right Publishers, Hyderabad.
2. Jain R. K., Iyengar S. R. K (2008), *Advanced Engineering Mathematics,* 3rd edition, Narosa Publication House, New Delhi.
3. Dass H. K ,Rajnish Verma Er (2007), *Higher Engineering Mathematics*, First Edition, S. Chand & Company Limited, New Delhi.

B. Tech. AE II SEMESTER

ENVIRONMENTAL SCIENCE
(Common to ME, EEE, AE & CE)

Subject Code: **A1004**

L	T	P	C
4	-	-	4

UNIT - I

ENVIRONMENTAL SCIENCE INTRODUCTION AND NATURAL RESOURCES: *Introduction:* Multidisciplinary nature of environmental studies: definition, scope and importance, need for public awareness. *Natural Resources:* Renewable and non-renewable resources .Natural resources and associated problems. *Forest Resources:* Use and over - exploitation, deforestation, timber extraction, mining, dams and other effects on forest and tribal people. *Water Resources:* Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. *Mineral Resources:* Use and exploitation, environmental effects of extracting and using mineral resources. *Food Resources:* World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, Organic farming and Food miles. *Energy Resources:* Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies. *Land Resources:* Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - II

ECOSYSTEM AND BIODIVERSITY: *Ecosystems:* Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers. Energy flow in the ecosystem - ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans and estuaries). *Biodiversity and Its Conservation:* Introduction - definition: genetic, species and ecosystem diversity, value of biodiversity- consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as mega diversity nation, hot-sports of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife, man -wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity- in-situ and ex-situ conservation of biodiversity.

UNIT - III

ENVIRONMENTAL POLLUTION, GLOBAL ENVIRONMENTAL ISSUES AND CONTROL MEASURES: *Environmental Pollution:* definition, cause, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and nuclear hazards. *Solid Waste Management*: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, pollution case studies. *Disaster Management*: Floods, earthquake, cyclone and landslides. E-waste and plastic waste - recycling and reuse. *Social Issues and the Environment*: From unsustainable to sustainable development, urban problems related to energy. *Water Conservation*: Rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns, case studies, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case Studies, wasteland reclamation.

UNIT - IV

GREEN ENVIRONMENTAL ISSUES: Introduction, Clean development mechanism, Carbon foot printing, Carbon credits, Carbon sequestration, Polluter pay principle. Green building, practices, approaches to green computing, Nanotechnology IS014000. Role of Information Technology in environment and human health, case studies.

UNIT - V

ENVIRONMENTAL ETHICS, ENVIRONMENTAL IMPACT ASSESMENT & ROLE OF NGOs: *Environmental Ethics:* Environment protection act, air (prevention and control of pollution) act, water (prevention and control of pollution) act, wildlife protection act, forest conservation act, issues involved in enforcement of environmental, legislation, public awareness. *Environmental Impact Assesment*: Conceptual facts of EIA, baseline date acquisition, planning and management of impact studies, operational aspects of EIA, methods for impact identification, prediction of impacts(air, water, noise, soil, biological and socio-economics), environmental management plan, role of NGOs in creating awareness among people regarding environmental issues.

TEXT BOOKS:

1. Benny Joseph (2005), *Environmental Studies*, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Erach Bharucha (2005), *Textbook of Environmental Studies for Undergraduate Courses*, Universities Press, Hyderabad.

REFERENCE BOOKS:

1. Anji Reddy. M (2007), Textbook of Environmental Sciences and Technology, BS Publications, Hyderabad.
2. Rajagopalan. R (2009), Environmental Studies, Oxford University Press, New Delhi.
3. Anubha Kaushik (2006), Perspectives in Environmental Science, 3rd Edition, New age international, New Delhi.

B. Tech. AE II SEMESTER

COMPUTER PROGRAMMING
(Common to ME, AE & CE)

Course Code: **A1501**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION TO COMPUTERS: Introduction to computers, computer systems, computing environments, computer languages, creating and running programmes, software development method, algorithms, pseudo code, flow charts, applying the software development method.

INTRODUCTION TO C LANGUAGE: Basic structures of C language, C tokens, data types and sizes, declaration of variables, assigning values

OPERATORS AND EXPRESSIONS: Statements, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bitwise operators, type conversions, expressions and evaluation, input and output statements, sample programs.

UNIT - II

CONTROL STATEMENTS: If and switch statements, while, do while and for statements, sample programs.

FUNCTIONS: Defining and accessing, passing arguments, function prototypes, library functions, static functions, user defined functions, recursive functions, variables and storage classes, scope rules, block structure, header files, C preprocessor, example C programs.

ARRAYS: Defining and processing, one dimensional and two dimensional arrays, initialization, passing arrays to a function, multi dimensional arrays, command line arguments.

UNIT - III

STRINGS: Defining and operations on strings, string variables declaration, reading, writing. Basics of functions, parameter passing, string handling functions.

POINTERS: Basic Concepts, pointer to pointer, passing pointers to a function, operations on pointers, pointer arithmetic, pointers and arrays, arrays of pointers, function pointers, dynamic memory allocation.

UNIT - IV

STRUCTURES AND UNIONS: Structure definition, initializing, assigning values, passing of structures as arguments, arrays of structures, pointers to structures, self reference to structures, unions, typedef, bit fields, sample programs.

UNIT - V

CONSOLE AND FILE I/O: File, types of files, file vs. console, file structure, file attributes, file operations, standard I/O, formatted I/O, sample programs.

TEXT BOOKS:

1. B. A. Fouruzan and R. F. Gilberg (2006), *Computer Science: A structured programming approach using C,* 3rd edition, Thomson Publications, New Delhi.
2. Yashawanth Kanethkar (2008), *Let us C*, 8th edition, Jones & Bartlett Publishers, India.

REFERENCE BOOKS:

1. Herbert Schildt (2000), *C: The Complete Reference*, 4th Edition, New Delhi, Osborne Mc Graw Hill.
2. B. W. Kerninghan, Dennis M. Ritche (1988), *The C Programming Language*, 2nd edition, Prentice Hall Software Series, India.
3. Stephen G.Kochan (2004), *Programming in C*, 3rd Edition, Pearson Education Private Limited.

B. Tech. AE II SEMESTER

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to ME, AE & CE)

Course Code: **A1202**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION TO ELECTRICAL ENGINEERING: Essence of electricity, conductors, semiconductors and insulators (elementary treatment only); electric field; electric current, potential and potential difference, electromotive force, electric power, ohm's law, basic circuit components, electromagnetism related laws, magnetic field due to electric current flow, force on a current carrying conductor placed in a magnetic field, faradays laws of electromagnetic induction. Types of induced EMF's, Kirchhoff's laws, simple problems.

UNIT - II

ALTERNATING QUANTITIES: Principle of AC voltages, waveforms and basic definitions, root mean square and average values of alternating currents and voltages, form factor and peak factor, phasor representation of alternating quantities, J operator and phasor algebra, analysis of AC circuits with single basic network element, single phase series circuits, single phase parallel circuits, single phase series parallel circuits, power in ac circuits.

UNIT - III

NETWORK THEOREMS: Superposition, reciprocity, thevenin's, norton's and maximum power transfer theorems with DC excitation.

INSTRUMENTS: Basic principle of indicating instruments - permanent magnet moving coil and moving iron instruments.

CATHODE RAY OSCILLOSCOPE: Principles of CRT (Cathode Ray Tube), deflection, sensitivity, electrostatic and magnetic deflection, applications of CRO - voltage, current and frequency measurements.

UNIT - IV

DIODE AND ITS CHARACTERISTICS: P-N junction diode, symbol, V-I characteristics, rectifiers - half wave, full wave and bridge rectifiers (simple Problems).

UNIT - V

TRANSISTORS: P-N-P and N-P-N junction transistor, CE, CB and CC transistor configurations.

TEXT BOOKS:

1. T. K. Nagasarkar, M. S. Suhkija (2007), Basic Electrical Engineering, 2nd Edition, Oxford University Press, New Delhi.
2. S. Salivahanan, N Suresh Kumar, A. Vallavaraj (2007), *Electronic Devices and Circuits, Tata* McGraw Hill, India.

REFERENCE BOOKS:

1. Sudhakar Shyam Mohan S P (2005), Network Analysis, 2nd Edition, Tata McGraw-Hill, New Delhi.
2. L. Thereja and A. K. Thereja (2008), A Text Book of Electrical Technology, First Edition, S. Chand & Company limited, New Delhi.
3. V. K. Mehta (2006), *Principles of Electrical Engineering and Electronics*, 2nd Edition, S. Chand & Company, New Delhi.
4. M. S. Naidu and S. Kamakshaiah (2011), Basic *Electrical Engineering*, 1st Edition, Mc Graw-Hill, New Delhi.
5. Kothari and Nagarath (2003), *Basic Electrical Engineering*, 2nd Edition, Tata Mc Graw-Hill, New Delhi.

B. Tech. AE II SEMESTER

ENGLISH LANGUAGE COMMUNICATION SKILLS LAB
(Common to ME, EEE, AE & CE)

Course Code: **A1009**

L	T	P	C
-	-	3	2

The Language lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

SYLLABUS:

The following course content is prescribed for the English Language Laboratory sessions:

1. Introduction to phonetics
2. Sounds of English- vowels, diphthongs & consonants
3. Introduction to stress and intonation
4. Oral presentations- prepared
5. Oral Presentations- Extempore
6. Situational dialogues / role play
7. 'Just A Minute' sessions (JAM)
8. Information transfer
9. Telephoning skills
10. Describing objects, situations and people
11. Giving directions
12. Listening for specific information
13. Listening to record telephone conversations
14. Debate

SUGGESTED SOFTWARE:

- Cambridge advanced learners' English dictionary with cd.
- The Rosetta stone English library.
- Clarity pronunciation power – part I.
- Oxford advanced learner's compass, 7th Edition.
- Learning to speak English - 4 CDs.
- Vocabulary in use, Michael McCarthy, felicity o'den, Cambridge.
- Murphy's English grammar, Cambridge with CD.

REFERENCE BOOKS:

1. Suresh Kumar. E. & Sreehari P.A *(*2007), *Handbook for English Language Laboratories,* Cambridge University Press India Pvt. Ltd, New Delhi.
2. Mandal S. K (2006), *Effective Communication & Public Speaking*, Jaico Publishing House, New Delhi.
3. Grant Taylor (2004), *English Conversation Practice,* Tata McGraw Hill, New Delhi.
4. Balasubramanian .T (2000), *A text book of English Phonetics for Indian Student, Mac* Millan Publishers, India.
5. Kamalesh Sadanand, Susheela Punitha (2008), *Spoken English: A foundation Course: Parts 1 & 2,* New Delhi, Orient Longman Pvt. Ltd.

B. Tech. AE II SEMESTER

COMPUTER PROGRAMMING LAB
(Common to ME, AE & CE)

Course Code: **A1502**

L	T	P	C
-	-	3	2

LIST OF EXPERIMENTS:

1. To write C programs for the following:
   a) Sum of individual digits of a positive integer.
   b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
   Write a C program to generate to generate the first n terms of the Fibonacci sequence.

2. a) To write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user
   b) To write a C program to calculate the following sum:
   Sum=1+x2/2!+X4/4! ————— upto given 'n' terms.
   c) To write a C program to find the roots of a quadratic equation.

3. To write C programs that uses both recursive and non-recursive functions
   a) To find the factorial of a given number.
   b) To find the GCD (greatest common divisor) of two given integers.
   c) To solve Towers of Hanoi problem.

4. The total distance traveled by vehicle in 't' seconds is given by distance=ut+1/2at2 where 'u' and 'a are the initial velocity (m/sec) and acceleration (m/sec2). Write a C program to find the distance traveled at regular intervals of time given values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

5. Using switch-case statement, write a C program that takes two operands and one operator from the user, performs the operation and then prints the answer. (consider operators +, -, *, and %).

6. Write a C program to find the largest and smallest number in a list of integers.

7. Write a C program that uses functions to perform the following
   a. Addition of Two Matrices
   b. Multiplication of Two Matrices

8. Write a C program that uses functions to perform the following operations
   a. To insert a sub-string in to given main string from a given position
   b. To delete n characters from a given position in given string.

9. Write a C program to determine if the given string is a palindrome or not.

10. a) Write a C program that displays the position or index in the string S where the string T begins, or -1 if S does not contain T.
    b) Write a C program to count the lines, words and characters in a given text.

11. To write a C program
    a) To generate Pascal's triangle
    b) To construct a pyramid of numbers

12. To write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression 1+x+x2+x3+…xn
    For example: if n is 3 and x is 5, then the program computes 1+5+25+125. Print x, n, the sum. Perform error checking. For example the formula does not make sense for negative
    Exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the nest pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.

13. To write a C program
    a) To find the 2's compliments of a binary number.
    b) To convert a Roman numeral to its decimal equivalent

14. To write a C program that uses functions to perform the following operations
    a. Reading a complex number
    b. Writing a complex number
    c. Addition of 2 complex numbers
    d. Multiplication of 2 complex numbers
    (Note: represent complex number using a structure)

15. To write a C program
    a) To copy the contents from one file to another.
    b) To reverse the first n characters in a file.
    (Note: the file name and n are specified on the command line)
    c) To fine the no. of characters, no. of words, no. of lines in a given file.

REFERENCE BOOKS:

1. Pradip Dey, Ghosh Manas (2009), *Programming in C,* Oxford University Press, USA.
2. E. Balaguruswamy (2009), *C and Data Structures,* 5th Edition, TMH publications, India.
3. M.K. Jain, S.R.K. Iyengar & R.K. Jain (2007), *Numerical Methods for Scientific and Engineering Computation,* 5th edition, New Age International Publishers, New Delhi.
4. Aitkinson, Han (2006), *Elementary Numerical Analysis*, 3rd Edition, John Wiley & Sons (Asia) Private Ltd., India.

B. Tech. AE II SEMESTER

ADVANCED ENGINEERING DRAWING
(Common to ME, AE & CE)

Course Code: **A1304**

L	T	P	C
-	2	3	2

UNIT - I

PROJECTIONS OF PLANES: Projections of plane by auxiliary plane method, auxiliary inclined plane, auxiliary vertical plane.

PROJECTIONS OF SOLIDS: Projections of solids by auxiliary plane method, auxiliary inclined plane, auxiliary vertical plane.

UNIT - II

SECTIONS AND SECTIONAL VIEWS: Right regular solids – prism, cylinder, pyramid, cone - auxiliary views.

DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of interpenetration of right regular solids.

UNIT - III

INTERSECTION OF SOLIDS: Intersection of cylinder vs cylinder, cylinder vs prism, cylinder vs cone, prism by another solid.

TRANSFORMATION OF PROJECTIONS: Conversion of isometric views to orthographic views –conventions.

UNIT - IV

ISOMETRIC PROJECTIONS: Principles of isometric projection - isometric scale – isometric views - conventions – isometric views of lines, plane figures, simple and compound solids – isometric projection of objects having non-isometric lines. Isometric projection of spherical parts.

UNIT - V

PERSPECTIVE PROJECTIONS: Perspective view: points, lines, plane figures and simple solids, vanishing point method and its alternative method, visual ray method and its alternative method.

AN INTRODUCTION TO COMPUTER AIDED DRAFTING: Generation of points, lines, curves, polygons, simple solids, dimensioning.

TEXT BOOKS:

1. N. D. Bhat (2006), *Engineering Drawing*, Charotar Publications, New Delhi.

REFERENCE BOOKS:

1. Venugopal (2010), *Engineering Drawing and Graphics*, 2nd edition, New age publications, New Delhi.
2. Johle (2009), *Engineering Drawing*, Tata Mc Graw Hill, New Delhi, India.
3. R.B. Choudary (2005), *Engineering graphics with Auto CAD*, Anuradha Publishers, New Delhi.

SYLLABI FOR III SEMESTER

B. Tech. AE III SEMESTER

MATHEMATICS FOR AEROSPACE ENGINEERS

Course Code**: A1012**

L	T	P	C
4	-	-	4

UNIT - I

SPECIAL FUNCTIONS: Gamma and Beta functions and their properties, evaluation of improper integrals. *Bessel's functions:* properties, recurrence relations, orthogonality of Bessel functions. *Legendre functions:* Legendre Polynomials, properties, recurrence relations, orthogonality of Legendre polynomials, Rodrigue's formula.

UNIT - II

FUNCTIONS OF A COMPLEX VARIABLE: Continuity, differentiability, analyticity and properties of analytic functions. Cauchy - Riemann equations in Cartesian and Polar co-ordinates, Harmonic and conjugate harmonic functions, Milne - Thomson method.

ELEMENTARY FUNCTIONS: Exponential, trigonometric, hyperbolic functions and their properties, general power of z^a (a is complex), Principal value.

UNIT - III

COMPLEX INTEGRATION: Line integral, evaluation of Line Integral along a path and by indefinite integration, Cauchy's integral theorem, Cauchy's integral formula and generalized Cauchy's integral formula.

COMPLEX POWER SERIES: Radius of convergence, expansion in Taylor's series, Maclaurin's series and Laurent's series. Zeros, singular points and poles of an analytic function.

UNIT - IV

CALCULUS OF RESIDUES: *Residue:* Evaluation of residues by formula and by Laurent's series, Residue theorem, Evaluation of Integrals of the type:

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{0}^{2\pi} f(\cos\theta, \sin\theta)d\theta$

(c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$ (d) Integration by indentation

UNIT - V

CONFORMAL MAPPING: Transformation by $z+\frac{1}{z},\ z^2,\ z^n (n \in z^+),\ e^z, \log z,\ \sin z,\ \cos z$.*Bilinear transformation*: Translation, rotation, inversion, fixed points, properties and invariance of cross ratio under bilinear transformation. Determination of bilinear transformation mapping three given points.

TENSOR ANALYSIS: Introduction to tensor analysis. Summation to convention, co-variant and contra variant tensors, Fundamental and reciprocal tensors and christoffel symbols.

TEXT BOOKS:

1. Iyengar T. K. V, Krishna Gandhi B. & Others. (2011), *Engineering Mathematics Vol - III*, 9th Revised edition, S. Chand & Co. Ltd, New Delhi.
2. N. P. Bali, Dr. N. Ch. Narayana Iyengar (2004), *A Textbook of Engineering Mathematics*, 6th edition, Laxmi Publications (P) Ltd, New Delhi.

REFERENCE BOOKS:

1. Dr. B. S. Grewal (2010), *Higher Engineering Mathematics,* 40th edition, Khanna Publishers, New Delhi.
2. Brog S. F (1990), *Matrix-Tensor Methods in Continuum Mechanics,* 2nd edition, World Scientific, Teaneck, New Jersey.

B. Tech. AE III SEMESTER

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS
(Common to AE, CSE, IT, EEE & CE)

Course Code: **A1013**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION TO MANAGERIAL ECONOMICS: Definition, Nature and Scope Managerial Economics, *Demand Analysis:* Demand Determinants, Law of Demand and its exceptions.

ELASTICITY OF DEMAND: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)**.**

UNIT - II

THEORY OF PRODUCTION AND COST ANALYSIS: Production Function, Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Production function, Laws of Returns, Internal and External Economies of Scale.

COST ANALYSIS: Cost concepts, Opportunity cost, fixed vs. variable costs, explicit costs vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break Even Analysis (BEA), termination of Break Even Point (simple problems), Managerial Significance and limitations of BEA.

UNIT - III

INTRODUCTION TO MARKETS AND PRICING STRATEGIES: *Market structures*: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition.

PRICE DETERMINATION AND PRICE STATISTICS: Price-Output Determination in case of Perfect Competition and Monopoly, Pricing Strategies.

UNIT - IV

BUSINESS AND NEW ECONOMIC ENVIRONMENT: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario.

CAPITAL AND CAPITAL BUDGETING: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Nature and scope of capital budgeting, features of capital budgeting proposals, *Methods of Capital Budgeting:* Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

UNIT - V

INTRODUCTION TO FINANCIAL ACCOUNTING: Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

FINANCIAL ANALYSIS THROUGH RATIOS: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt-Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

TEXT BOOKS:

1. Aryasri (2005), *Managerial Economics and Financial Analysis,* 2nd edition, Tata McGraw Hill, New Delhi, India.
2. Varshney, Maheswari (2003), *Managerial Economics,* Sultan Chand, New Delhi, India.

REFERENCE BOOKS:

1. Ambrish Gupta (2004), *Financial Accounting for Management,* Pearson Education, New Delhi, India.
2. Domnick Salvatore (2011), *Managerial Economics in a Global Economy,* 7th edition, Oxford University Press, United States of America.
3. Narayanaswamy (2005), *Financial Accounting, A Managerial Perspective,* Prentice Hall of India private Ltd, New Delhi, India.

B. Tech. AE III SEMESTER

INTRODUCTION TO AIRCRAFT INDUSTRY

Course Code**: A1701**

L	T	P	C
4	-	-	4

UNIT - I

AIRCRAFT INDUSTRY OVERVIEW: Evolution and History of Flight, Types Of Aerospace Industry, Introduction to ages of engineering, Aerospace Manufacturing, Introduction to the space environment & human space exploration.

UNIT - II

INTRODUCTION TO AIRCRAFTS, DURATION: Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Device. Types of Aircrafts: Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft. Advantages and disadvantages of these Configurations.

UNIT - III

INTRODUCTION TO AIRCRAFT SYSTEMS: Types of Aircraft Systems. Mechanical Systems. Electrical and Electronic Systems. Auxiliary systems.

MECHANICAL SYSTEMS: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems Auxiliary Power Unit.

ELECTRICAL SYSTEMS: Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System.

UNIT - IV

BASIC PRINCIPLES OF FLIGHT: Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects. Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag.

UNIT - V

BASICS OF FLIGHT MECHANICS: Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects.

STABILITY AND CONTROL: Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers and Shock Waves.

AIRCRAFT PERFORMANCE AND MANEUVERS: Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on a Aeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability.

TEXT BOOKS:

1. Anderson J.D. (2012), *Introduction to Flight*, 7th edition, McGraw Hill, New York.
2. Anderson J.D.(2011), *Aircraft Performance and Design*, Tata McGraw Hill Education Private Limited, New Delhi
3. Shevell (2004), *Fundamentals of Flight*, 2nd edition, Pearson Education Limited, New Delhi
4. Allan Seabridge, Ian Moir (2008), *Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration,* 3rd edition, John Willey & Sons, New York.

REFERENCES BOOKS:

1. A.C. Kermode (2012), *Mechanics of Flight*, 12th edition, Pearson Education Limited, New Delhi.
2. Kermode, A.C. (1989), *Flight without Formulae*, 5th edition, Pearson Education Limited, New Delhi.
3. Raymer Daniel (2002), *Aircraft Design: A Conceptual Approach*, AIAA Publisher, USA.

B. Tech. AE III SEMESTER

MECHANICS OF SOLIDS
(Common to AE & ME)

Course Code: **: A1306**

L	T	P	C
3	1	-	4

UNIT - I

SIMPLE STRESSES AND STRAINS: Elasticity and plasticity, Types of stresses and strains, Hooke's law stress, strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain, Elastic module and the relationship between them, Bars of varying section, composite bars, Temperature stresses. Strain energy, Resilience - Gradual, Sudden, Impact and Shock loadings.

UNIT - II

SHEAR FORCE AND BENDING MOMENT: Definition of beam, Types of beams, Concept of shear force and bending moment, Relation between Shear Force and Bending Moment. and rate of loading at a section of a beam. Shear Force and Bending Moment diagrams for cantilever simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads, Point of contra flexure.

UNIT - III

FLEXURAL STRESSES: Theory of simple bending, Assumptions, Derivation of bending equation: M/ I = f/y = E/R Neutral axis, Determination bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beam sections.

SHEAR STRESSES: Derivation of formula, Shear stress distribution across various beams sections like rectangular, circular, I, T, angle sections.

UNIT - IV

ANALYSIS OF PIN-JOINTED PLANE FRAMES: Determination of Forces in members of plane, pin jointed, perfect trusses by (i) method of joints and (ii) method of sections. Analysis of various types of simply supported trusses- by method of joints, method of sections.

DEFLECTION OF BEAMS: Bending into a circular arc slope, deflection and radius of curvature, Differential equation for the elastic line of a beam, Double integration and Macaulay's methods, Determination of slope and deflection for cantilever and simply supported beams subjected to point loads.

UNIT - V

THIN CYLINDERS: Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses hoop, longitudinal and volumetric strains, changes in dia, and volume of thin cylinders, Riveted boiler shells, Thin spherical shells. A thick cylinder lame's equation, cylinders subjected to inside and outside pressures, compound cylinders.

TEXT BOOKS:

1. Ramamrutham. S (2012), Strength *of materials*, 17th edition, Dhanpat Rai Publications, New Delhi, India.
2. Timoshenko. S (2004), *Strength of materials*, 3rd edition, CBS Publishers, New Delhi, India.

REFERENCE BOOKS:

1. Ryder G. H (2007), *Strength of materials*, 3rd edition, Macmillan, New Delhi, India.
2. Bhavikathi S. S (2008), *Strength of materials*, 3rd edition, Vikas Publishing House, New Delhi, India.

Dr. Bansal R. K (2007), Strength of materials, 10th edition, Laxmi Publications, Hyderabad, India.

B. Tech. AE III SEMESTER

MECHANICS OF FLUIDS
(Common to AE, ME & CE)

Course Code: **: A1307**

L	T	P	C
4	-	-	4

UNIT - I

FLUID PROPERTIES AND FLUID STATICS: Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Surface tension Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Hydro static law, Piezometer, Simple and differential manometers, pressure gauges, total pressure and center of pressure plane, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT - II

FLUID KINEMATICS : Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flows, Continuity equation in 3D flow, stream function, velocity potential function.

FLUID DYNAMICS: Surface and Body forces, Euler's and Bernoulli's equation derivation, Navier stokes equation (explanation only), Momentum equation - applications, Vortex Free and Forced. Forced vortex with free surface.

UNIT - III

SIMILITUDE AND FLOW MEASUREMENT: Flow through venturimeter and orifice meter, flow through notches and weirs Viscometers hot weir anenomometers, pitot tube flow through nozzles, Characteristics of real fluids.

REYNOLDS EXPERIMENT: Darcy's equation, Minor losses - pipes in series, pipes in parallel, total energy line and hydraulic gradient line, numerical problems.

UNIT - IV

BOUNDARY LAYER CONCEPTS: Definition, thicknesses, characteristics along thin plate, laminar and turbulent layers (No Derivation) boundary layer in transition, separation of boundary layer submerged objects drag and lift.

UNIT - V

FLOW OF COMPRESSIBLE FLUID: Introduction, Thermodynamic relations, basic equations of compressible flow, Velocity of sound wave in a fluid for isothermal and adiabatic process, Mach number and its applications, Mac angle propagation of pressure waves and stagnation properties.

TEXT BOOKS:

1. P. N. Modi, S. M. Seth (2011), *Hydraulics and fluid mechanics including hydraulic machines*, 18th revised edition Standard Book House, India.
2. Yumus A. Cengel, John M. Cimbala (2010), *Fluid Mechanics (SI Units),* 2nd edition, Tata McGraw hill education (P) Ltd, New Delhi, India.

REFERENCE BOOKS:

1. R. K. Bansal (2011), *A Textbook of Fluid Mechanics and Hydraulic Machines*, 10th edition, Laxmi Publications, New Delhi, India.
2. Frank M. White (2011), *Fluid Mechanics*, 7th edition, Tata McGraw Hill, New Delhi, India.
3. John F. Dauglas (2005), Fluid *Mechanics*, 5th edition, Pearson Education Limited, New Delhi, India.

B. Tech. AE III SEMESTER

THERMODYNAMICS
(Common to AE & ME)

Course Code: **: A1308**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION: *Basic Concepts:* System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle, Reversibility, Quasi static Process, Irreversible Process, Causes of Irreversibility, various flow and non flow process Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics, Concept of quality of Temperature, Principles of Thermometry, Reference Points, Const. Volume gas Thermometer, Scales of Temperature, Ideal Gas Scale, PMMI - Joule's Experiments, First law of Thermodynamics, Corollaries First law applied to a Process, applied to a flow system, Steady Flow Energy Equation.

UNIT - II

LIMITATIONS OF THE FIRST LAW: Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase, Availability and Irreversibility, Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations, Elementary Treatment of the Third Law of Thermodynamics.

UNIT - III

PURE SUBSTANCES: P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations, Triple point at critical state properties during change of phase, Dryness Fraction. Mollier charts, Various Thermodynamic processes and energy Transfer, Steam Calorimetry.

PERFECT GAS LAWS: Equation of State, specific and Universal Gas constants, Throttling and Free Expansion Processes, Deviations from perfect Gas Model, Vander Waals Equation of State.

UNIT - IV

MIXTURES OF PERFECT GASES: Mole Fraction, Mass friction Gravimetric and volumetric Analysis, Dalton's Law of partial pressure, Avogadro's Laws of additive volumes, Mole fraction , Volume fraction and partial pressure, Equivalent Gas const and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air.

UNIT - V

POWER CYCLES: Otto, Diesel, Dual Combustion cycles, Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis, comparison of Cycles. Introduction to Brayton cycle and Bell Coleman cycle.

TEXT BOOKS:

1. P. K. Nag (2008), *Engineering Thermodynamics*, 3rd edition, Tata McGraw-Hill, New Delhi, India.
2. Yunus Cengel, Boles (2011), *Thermodynamics - An Engineering Approach,* 7th edition, Tata McGraw-Hill, New Delhi, India.

REFERENCE BOOKS

1. J. B. Jones, R. E. Dugan (2009), *Engineering Thermodynamics*, 1st edition, Prentice Hall of India Learning, New Delhi, India.
2. Y. V. C. Rao (2009), *An introduction to Thermodynamics*, Revised Edition, Universities Press, Hyderabad, India.
3. K. Ramakrishna (2011), *Engineering Thermodynamics*, 2nd edition, Anuradha Publishers, India.

B. Tech. AE III SEMESTER

MECHANICS OF SOLIDS LAB

Course Code: **A1702**

L	T	P	C
-	-	3	2

LIST OF EXPERIMENTS:

1. Direct tension test
2. Bending test on Simple supported
3. Bending test on Cantilever beam
4. Torsion test
5. Hardness test by using Brinell's hardness test
6. Hardness test by using Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Impact test
10. Punch shear test

EQUIPMENT NEEDED:

MOS LAB

1. UTM – 20 / 40 Tons with load Vs Elongation graphical attachment and provision for Bending and sheering along with accessories and end grips
2. Deflection test rig (Fabricated hardware + precession dial gauge)
3. Torsion testing Machine
4. Hardness testing Machine (Brinnel and Rockwell)
5. Impact Testing Machine
6. Spring testing Machine.

B. Tech. AE III SEMESTER

MECHANICS OF FLUIDS LAB

Course Code: **A1703**

L	T	P	C
-	-	3	2

LIST OF EXPERIMENTS:

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouthpiece by variable head method.
5. Calibration of contracted Rectangular Notch
6. Calibration of contracted Triangular Notch
7. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
8. Verification of Bernoulli's equation.
9. Determination of the surface profile of free vortex.
10. Determination of the surface profile of force vortex.
11. Potential flow in fluid dynamics.
12. Causes and effect of cavitation.
13. Determination of fluid density and specific gravity.
14. Verification of Archimedes' principle and demonstration of principles of flotation.
15. Measurement of force and centre of pressure on a plane surface.

EQUIPMENT NEEDED:

MOF LAB

1. Venturimeter test rig
2. Test rig for Flow over notch
3. Pipe friction apparatus
4. Bernoulli's apparatus
5. Test rig for Orifice meter
6. Mouthpiece apparatus.
7. Vortex apparatus.
8. Hele-shaw apparatus.
9. Cavitations demonstration unit.
10. Hydrostatics and properties of fluids.

SYLLABI FOR IV SEMESTER

B. Tech. AE IV SEMESTER

ELECTRICAL TECHNOLOGY
(Common to AE, ME & CE)

Course Code: **A1215**

L	T	P	C
4	-	-	4

UNIT - I

DC GENERATORS: Principle of operation of DC Generator, EMF equation, Types of generators, Magnetization and load characteristics of DC generators.

DC MOTORS: DC Motors, Types of DC Motors, Characteristics of DC motors, 3-point starters for DC shunt motor, Losses and efficiency, Swinburne's test, Speed control of DC shunt motor, Flux and Armature voltage control methods.

UNIT - II

TRANSFORMERS: Principle of operation of single phase transformer, types, Constructional features, Phasor diagram on No Load and Load Equivalent circuit.

PERFORMANCE OF TRANSFORMERS: Losses and Efficiency of transformer and Regulation - OC and SC tests, Predetermination of efficiency and regulation (Simple Problems).

UNIT - III

THREE PHASE INDUCTION MOTORS: Principle of operation of three-phase induction motors, Slip ring and Squirrel cage motors, Slip-Torque characteristics, Efficiency calculation, Starting methods.

UNIT - IV

ALTERNATORS: Alternators, Constructional features, Principle of operation, Types, EMF Equation, Distribution and Coil span factors, Predetermination of regulation by Synchronous Impedance Method, OC and SC tests.

SYNCHRONOUS MOTOR: Principle of operation, Numerical problems.

UNIT - V

SINGLE PHASE MOTORS: Principle of operation, Shaded pole motors, Capacitor motors, AC servomotor, AC tachometers, Synchros, Stepper Motors, Characteristics.

TEXT BOOKS

1. B. L. Theraja, A. K. Theraja (2010), E*lectrical Technology,* 3rd edition, S. Chand Publishers, New Delhi, India.
2. J. B. Gupta (2006), *Electrical Machines*, 14th edition, S. K. Publishers, New Delhi, India.

REFERENCE BOOKS

1. V. K. Mehta (2002), *Principles of Electrical Engineering*, S. Chand Publications, New Delhi, India.
2. I. J. Nagarath, D. P. Kothari (2004), *Theory and Problems of basic electrical engineering*, 4th edition, Prentice Hall of India, New Delhi, India.
3. M. S. Naidu, S. Kamakshaiah (2002), *Principles of Electrical Engineering*, 6th edition, Tata Mc Grew Hill Publications, New Delhi, India.

B. Tech. AE IV SEMESTER

AERODYNAMICS - I

Course Code: **A1704**

L	T	P	C
4	-	-	4

UNIT - I

BASICS: Wing and Airfoil section geometry, Aerodynamic forces and moments, Force and moment components and coefficients, Pressure distribution on an airfoil, Types of drag, Estimation of lift, Drag and pitching moment coefficient from the pressure distribution. Experimental methods, wake survey.

UNIT - II

ELEMENTARY FLOWS: Incompressible flow condition, Governing equation for irrotational, incompressible flow: Laplace's equation, Boundary conditions. Elementary flows. Combination of uniform flow with a Source and Sink, Doublet. Flow over a circular cylinder, Vortex flow. Circulation, Kutta-Joukowski theorem. Lifting flow over a cylinder The vortex sheet. Kelvin circulation theorem and starting vortex.

UNIT - III

INCOMPRESSIBLE FLOW OVER AIRFOILS: The complex potential function and conformal transformation, The Kutta-Zhukovsky transformation. Kutta condition. Lift on the Zhukovsky airfoil section.

THIN AIRFOIL THEORY: Classical thin airfoil theory for symmetric and cambered airfoil sections. Comparison of theoretical and experimental results. Limitations of thin airfoil theory.

UNIT - IV

INCOMPRESSIBLE FLOW OVER FINITE WINGS: Vortex filament, Biot-Savart law and Helmholtz's theorems, Prandtls classical lifting line theory: Downwash and induced drag. Elliptical and modified elliptical lift distribution. Lift distribution on wings. Limitations of Prandtl's lifting line theory.

EXTENDED LIFTING LINE THEORY: Extended lifting line theory- lifting surface theory, vortex lattice method for wings. Lift, drag and moment characteristics of complete airplane.

UNIT - V

SOURCE PANEL METHOD: Source panel method, non-lifting flow over an arbitrary bodies, potential flow over a circular cylinder.

VORTEX PANEL METHOD: Vortex panel methods, Lifting flow over an arbitrary body, flow over a symmetrical airfoil

TEXT BOOKS:

1. Anderson J .D.(2011), *Fundamental of Aerodynamics,* 5th edition, McGraw-Hill International Edition, New York
2. E. L. Houghton, P.W. Carpenter (2010), *Aerodynamics for Engineering Students*, 5th edition, Elsevier, New York.

REFERENCE BOOKS:

1. Clancy L. J. (2006), *Aerodynamics*, Sterling book house, New Delhi.
2. Louis M. Milne-Thomson (2011), *Theoretical Aerodynamics*, Imported Edition, Dover Publications, USA.

B. Tech. AE IV SEMESTER

AIRCRAFT PRODUCTION TECHNOLOGY

Course Code: **A1705**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION: Classification and comparison (merits and limitations) of manufacturing process, criterion for selection of a process, General principles of various Casting Processes, Sand casting, die-casting, centrifugal casting, investment casting, shell moulding types.

UNIT - II

WELDING AND BONDING TECHNIQUES: Principles and equipment used in arc welding, gas welding, resistance welding, thermit welding, recent advances in welding technology, Soldering and brazing techniques.

UNIT - III

MACHINING: General Principals (with schematic diagram only) of working of engine lathe, shaper, milling machines, grinding, drilling m/c.

SHEET METAL: Sheet metal materials, tools and operations like shearing, punching, dropstamp forming, Advanced metal forming (super plastic forming and diffusion bonding). Bend correction for bending in single plane, Automation in bend forming and different operations in bending like stretch forming spinning drawing etc.

UNIT- IV

UNCONVENTIONAL MACHINING: Principles (with schematic diagram only) of working and applications of abrasive jet machining, ultrasonic machining, electric discharge machining, electro chemical machining, laser beam/electron beam/plasma arc machining

HEAT TREATMENT AND SURFACE FINISHING: Heat treatment of Aluminium alloys, titanium alloys, steels, case hardening, Initial stresses and the stress alleviation procedures. Corrosion prevention, protective treatment for aluminium alloys, steels, anodizing of titanium alloys, organic coating, and thermal spray coatings. Grinding and Polishing, Technology of surface finish.

UNIT - V

JIGS AND FIXTURES: Introduction of Jigs and Fixtures, Stages of Assembly, types and equipment for different joints.

QUALITY CONTROL AND ASSURANCE: Concepts and definitions of quality, reliability, quality circles, zero defect program: international standards, six-sigma quality.

NDT AND OTHER INSPECTION TECHNIQUES: Dye Penetrate Test, X - ray, magnetic particle and ultrasonic testing.

TEXT BOOKS:

1. Keshu S. C, Ganapathy K. K (2012), *Air craft production techniques*, E-book, Interline Publishing House, Bangalore.
2. Kalpakjian serope (2011), *Manufacturing Engineering and Technology*, 5th edition, Pearson Education, New Delhi, India.

REFERENCE BOOKS:

1. R. K. Jain (2012), *Production technology*, 17th edition, Khanna Publishers, New Delhi.
2. P. C. Sharma (2011), *Manufacturing Technology - I & II*, 1st edition, S. Chand & Company Ltd. New Delhi

B. Tech. AE IV SEMESTER

AEROSPACE VEHICLE STRUCTRE - I

Course Code: **A1706**

L	T	P	C
3	1	-	4

UNIT - I

REDUNDANT STRUCTURES: Indeterminate structure and order of redundancy , Introduction to redundant analysis, statically determinate models, use of free body diagrams to explain compatibility and redundant analysis principles, Matrix methods of redundant analysis utilizing (a) equilibrium equations /compatibility conditions and (b) Singularity method for uniform beams with various boundary and support conditions (props, hinges and fixities) subjected to distributed / desecrate loads (including moment).

UNIT - II

BEAMS WITH ELASTIC SUPPORT AND INTIAL CURVATURE: Direct solution of beams on elastic foundation, Deflection of beams with discrete elastic support using singularity methods and modeling concepts, equation of equilibrium for beam (Bulk head segments on fuselages).

STABILITY: Stability of structural systems, Models of instability of columns. Euler's formula for critical loads of column. Slenderness ratio, Effect of boundary conditions on mode shapes and critical loads. Column with initial curvature, effect of eccentricity Long, Medium and short column ranges. Rankine and Johnson's formulae. Eigen values and Eigen modes. Effect of intermediate supports. Concept of beam column.

UNIT - III

INTRODUCTION TO ELASTICITY: Equilibrium and Compatibility conditions for elastic solids, 2D elasticity equations for plane stress, plane strain and generalized plane strain causes Airy's stress function. Simple problems in plane strss/plane strain using Cartesian and polar subjected to generalized plane strain Biaxial loading (b) Uniform/linearly varying edge on elastic half plane(c) Thick cylindrical shells.

THEORY OF ELASTICITY: Stresses and strains on arbitrary planes and transformations. Concept of principle planes, stress and Strains, Construction of Mohar's circle, Faailure mechanism and facture modes.

UNIT - IV

ENERGY PRINCIPLES AND METHODS: Introduction to energy principle and methods. Principle of virtual Displacements and principle of Virtual Force Castigliano's theromes, maxerll's reciprocal thermo and unit load method. Direct application of energy principle to beams and trusses. The displacement method (Raylegih Ritz method). Admissible function energy and work expression for redundant analysis of 1- D structure 9rods, shafts, and beams). Various ID Structure subjects to Complex loading Stress of errors and convergence.

UNIT - V

SHEAR FLOW IN CLOSED SECTIONS: Bredt- Batho formula. Single and multi-cell closed box structures. Semi monocoque and moncoque structures. Approximate method for box beams. Shear flow in single and multicell monocoque and semi monocoque box beams subject to torsion.

TEXT BOOKS:

1. Megson T. H. G (2012), *Aircraft Structures for Engineering Students*, 5th edition, Elsevier, New York.
2. David J. Perry (2011), *Aircraft Structures*, 2nd edition, McGraw Hill, New Delhi.

REFRENCE BOOKS:

1. Irving Herman Shames, Clive L. Dym (2003), *Energy and finite element methods structural analysis,* McGraw Hill, New Delhi, India.
2. B. C. Punmia (2011), *Theory of Structures*, 13th edition, Laxmi Publications Ltd, Hyderabad.
3. Donaldson B. K (2008), *Analysis of Aircraft Structures an introduction to Aeronautical Structures Analysis*, 2nd edition, Cambridge University Press, USA.

B. Tech. AE IV SEMESTER

FLIGHT MECHANICS - I

Course Code: **A1707**

L	T	P	C
3	1	-	4

UNIT - I

INTROUDUCTION TO AIRCRAFT PERFORMANCE: The role and design mission of an aircraft specification of the performance requirements and mission profile. Importance of performance analysis, estimation and measurements and operations safety and economy. Scheduled performance and operational performance of aircraft. The standards Atmosphere. Off - standards and design atmosphere. Measurements of air data. Air data computers.

UNIT - II

THE FORCE SYSTEM OF THE AIRCRFT: Equations of motion for performance the aircraft force system. The lift force, side forces the drag force. Total airplane drag- drag estimation drag reduction methods. The propulsive forces the thrust producing engine, power and specific fuel consumption with altitude and flight speed. The minimum drag speed, minimum power speed. Aerodynamic relationships foe a parabolic drag polar.

CIRUISE PERFORMANCE: The maximum minimum speeds in level flight range and endurance of aircraft with thrust producing engines, and with power producing engines. Cruise techniques: constant angle of attack, constant Match number, constant Match number methods, comparison of performance. The effect alternative fuel flow laws, the effect of weight, altitude and temperature on cruise performance. Cruise performance of aircraft with mixed power plants.

UNIT - III

CLIMB AND DESCENT PEROFRMANCE: Importance of climb and descent performance, safety considerations. Climb and descent techniques, generalized performance analysis for thrust producing, power producing and mixed power plants, maximum climb gradient, climb rate. Energy height and specific excess power, energy methods for optimal climbs, minimum time climbs, minimum fuel climbs, Measurements of climb performance. Descent performance in aircraft operations. Effect of wind on climb and decent performance.

AIRCRAFT MANOEUVRE PERFORMANCE: The general equations of accelerated motion of aircraft maneuver envelope, significance. Longitudinal aircraft maneuver, the pull – up maneuver, Lateral maneuvers, turn performance, instantaneous turns and sustained turns, specific excess power, the energy turns. The maneuver aircraft maneuver performance.

UNIT - IV

AIRCRAFT PEROFRMACE MESUREMENTS AND DATA HANDLING: Purpose of performance measurements in flight. Flight testing Principle performance variables weight, altitude and ambient temperature (WAT). Parametric performance data analysis. Dimensional analysis. Measurements data reduction. The equivalent weight method. Correction to cruise climb take – off and landing performance for weight and temperature.

SAFTEY REQUIRMENTS TAKE-OFF AND LANDING PERFORANCE PLANNING: Flight safety criteria. Performance classification civil. Flight plans, performance planning and fuel planning Estimation of take off distances. The effect on the take – off distance, of weight wind runaway conditions, ground effect. Take off performance safety factors. Estimation of landing distances, the discontinued landing baulked landing air safety procedures and requirements on performance. Fuel planning fuel requirements trip fuel, environment effects reserves, tinkering.

UNIT - V

THE APPLICATION OF PERFORMANCE DATA: The performance summary for fleet selection the block performance, payload – range diagram. Route analysis and optimization. Operational analysis procedure. Operational performance data for flight planning, take off field performance runaway correction chart, aircraft datum performance (WAT) chart, determination of the maximum takeoff weight

TEXT BOOKS:

1. Eshelby M. E (2000), *Aircraft performance: Theory and Practice*, AIAA Education Series, USA.
2. Brandt S. A. et al (2004), *Introduction to Aeronautics: A Design perspective*, 2nd edition, AIAA Education Series, USA.
3. Anderson J. D. (2011), *Aircraft Performance and Design*, international edition, McGraw Hill, New Delhi.

REFERNCE BOOKS:

1. Dole C. E. (2010), *Flight Theory and Aerodynamics; a practical Guide for Operational Safety*, Wiley India Ltd, New Delhi, India.
2. Mc Cormic B. W.(2010), *Aerodynamics, Aeronautics and Flight Mechanics*, 2nd edition, Wiley India Ltd. India
3. Raymer D. P (2006), *Aircraft Design: A Conceptual Approach*, 4th Edition, AIAA Education Series, USA.
4. Yethout (2003), *Introduction to Aircraft Flight Mechanics*, AIAA Education Series, USA.

B. Tech. AE IV SEMESTER

MECHANISMS AND MECHANICAL DESIGN

Course Code: **A1708**

L	T	P	C
3	1	-	4

UNIT - I

MECHANISMS: Elements of links, Classification Rigid link, flexible and fluid link. Types of kinematic pairs, sliding, turning, rolling, screw and spherical pairs, Lower ad higher pairs, Closed and open pairs. Constrained motion, completely, partially or successfully constrained and incompletely constrained.

MACHINES: Mechanism and machines, Classification of machines, Kinematic chain, Inversion of mechanism, Inversion of quadratic cycle, Chain: single and double slider crank chains. Exact and approximate Straight line Mechanisms-Peaucellier, Hart T. Chebibheff , Pantograph.

UNIT - II

KINEMATICS: Velocity and acceleration, Motion of link in machine. Determination of velocity and acceleration diagrams, Graphical method. Application of relative velocity method four bar chain.

ANALYSIS OF MECHANISMS: Analysis of slider crank chain for displacement, Velocity and acceleration of sliding. Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

UNIT - III

PLANE MOTION OF BODY: Instantaneous center of rotation, centroids and axodes. Relative motion between two bodies. Three centers in line theorem. Graphical determination of instantaneous center, diagrams for simple mechanisms and determination of angular velocity of points and links.

PRECISSION: Effect of Precission on Stability of moving vehicles such as motorcar motorcycle Aero planes and ships. Static and Dynamic forces generated due to in Precission in moving mechanisms including Gyroscopic motions.

UNIT - IV

CAMS: Definition of cam and followers, their uses. Types of followers and cams, Terminology, Types of follower motion. Uniform velocity, Simple harmonic motion and uniform acceleration. Maximum velocity and Maximum acceleration during out ward and return strokes in all the above three cases.

ANALYSIS OF MOTION OF FOLLOWERS: Roller follower, Circular cam with straight, concave and convex flanks.

UNIT - V

DESIGN OF MACHINE ELEMENTS: Principles of mechanical design, dimensional tolerances, fits. Design of common machine elements springs, shafts, couplings, Universal coupling.

GEARS AND GEAR TRAINS: Introduction to gears-types, Law of gearing, Tooth profiles, specifications, classification of Helical, Bevel and worm gears: Simple and reverted gear train, epicyclic gear trains-velocity ratio or train value

TEXT BOOKS:

1. Dr Jagdish Lal, J. M. Shaw (2003), *Theory of Mechanisms and Machines*, Metropolitan Book Co-Ltd, New Delhi.
2. P. L. Ballaney (2003), *Theory of Machines and Mechanisms*, Khanna Publisher, New Delhi.

REFERENCE BOOKS:

1. Amithab Ghosh, Asok Kumar Malik (2001), *Theory of Mechanisms and machines*, East West Press Private Limited, New Delhi.
2. J. E. Shigley, Charles, R. Mischke (2009), *Theory of Machines and Mechanisms*, Tata McGraw Hill, New Delhi.

B. Tech. AE IV SEMESTER

COMPUTER AIDED AIRCRAFT ENGINEERING DRAWING LAB

Course Code: **A1709**

L	T	P	C
-	-	3	2

Note: 40% Course Work should be done on Drawing Board & 60% Course Work should be done by computer.

UNIT - I

Machine Drawing conventions Need for Drawings conventions – Introduction to ISI - conventions.

a. Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
b. Types of sections – Selection planes and drawing of section and auxiliary sectional views. Parts not usually sectioned.
c. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and Tapered features
d. Title boxes, their, their size, location and details- common abbreviations and their liberal usage.
e. Types of drawing – working drawing for machine parts

UNIT - II

Drawing of Machine Elements and simple parts. Section of views, additional views for the following machine elements and parts with every drawing proportions.

a. Popular forms of screw threads, bolts, set screws and bolted joints.
b. Keys, cottered joint and knuckle joint
c. Riveted joints for plates
d. Shaft coupling, spigot and socket pipe joint
e. Journal, pivot, collar and foot step bearing
f. Welded joints and welding symbols

UNIT - III

Following simple Aircraft assembly drawings only.

a. Different types of trusses wings fuselage including ribs, strangers, skin, brackets.
b. Different elements of fuselage structure, bulk head, rings (frame) long, brackets.
c. Different types of fuselage
d. Landing gear basic elements, structural brackets, wheel, shook absorber and Hydraulic cylinder
e. Connecting rod aero piston engine

TEXT BOOKS:

1. Daniel P. Raaymer, *Aircraft Design a Conceptual Approach,* 3rd edition.
2. N. D. Bhat, V. M. Panchal (2012), *Machine drawing,* 50th edition*,* Charotar publication House.

REFERENCE BOOKS:

1. K. L. Narayana, P. Kannaiah, Venkata Reddy, *Machine Drawing,* New Age publication.

EQUIPMENT NEEDED:

1. Hardware assembly modal relevant to above needed for demonstration
2. Drawing Board with Mini drafting machines, 60 required for strength 60 capacity

B. Tech. AE IV SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING LAB
(Common to AE & ME)

Course Code: **A1216**

L	T	P	C
-	-	3	2

PART - A
ELECTRICAL ENGINEERING:

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine. (Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors)
3. Brake test on 3-phase Induction motor (Determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method.

In addition to the above four experiments, any one of the experiments from the following list is required to be conducted:

5. Speed control of D.C. Shunt motor by
    a. Armature Voltage control
    b. Field flux control method
6. Brake test on D.C Shunt Motor

PART - B
ELECTRONICS ENGINEERING:

1. Transistor CE Characteristics (Input and Output)
2. Full wave Rectifier with and without filters.
3. CE Amplifiers.
4. RC Phase Shift Oscillator
5. Class a Power Amplifier
6. Micro Processor

SYLLABI FOR V SEMESTER

B. Tech. AE V SEMESTER

AIR TRANSPORTATION SYSTEMS

Course Code: **A1710**

L	T	P	C
4	-	-	4

UNIT - I

AVIATION INDUSTRY: Introduction, history of aviation evolution, development, growth, challenges. Aerospace industry, air transportation industry, economic impact- types and causes. Airline Industry structure and economic characteristics. Airlines as oligopolists, other unique economic characteristics. Significance of airline passenger load factors.

UNIT - II

NATURAL ENVIRONMENT: The earth as a habitat, The Earth: physical issues affecting demand: surface, core, continents. Shape of demand. Demand forecasting based on historical data, comparative analysis, theoretical demand models. Reliability of forecasts, Atmosphere of earth- gaseous properties, distance and speed, weather- weather effects on navigation.

REGULATORY ENVIRONMENT: The breadth of regulation- ICAO, IATA, national authorities (DGCA, FAA). Service properties, service volumes, international air service agreements, deregulation, privatization. Safety regulations, risk assessment, human factors and safety, security regulations, environmental regulations.

UNIT - III

OPERATIONAL ENVIRONMENT: Introduction. Evolution, communication, navigation and surveillance systems (CNSS). Radio communications: VHF, HF, ACARS, SSR, ADS. Navigation- NDB, VOR, DME, area-navigation systems(R-Nav), ILS, MLS, GPS, INS, laser-INS. Surveillance- SSR, ADS . Airborne elements- AFCS, PMS, electronic control and monitoring /engine instrumentation and central automated systems, EFIS, FMS, GPWS, TCAS- future trends.

AIRCRAFT: Costs- project cash-flow, aircraft price. Compatibility with the operational infrastructure. Direct and indirect operating costs. Balancing efficiency and effectiveness, payload-range, fuel efficiency, technical contribution to performance, operating speed and altitude, aircraft field length performance. Typical operating costs. Effectiveness, wake-vortices, cabin dimensions, flight deck.

UNIT - IV

AIRLINES: Setting up an airline, modern airline objectives. Route selection and development, airline fleet planning, annual utilization and aircraft size, seating arrangements. Indirect operating costs. Aircraft buy or lease. Revenue generation, Computerized reservation systems, yield management. Integrating service quality into the revenue generation process. Marketing the seats. Airline scheduling. Evaluating success financial viability, regulatory compliance, efficient use of resources, effective service.

AIRPORTS: Setting up an airport- airport demand, airport setting, runway characteristics: length, declared distances, aerodrome areas, obstacle safeguarding. Runway capacity, evaluating runway capacity, sustainable runway capacity. Runway pavement length, Manoeuvring area airfield lighting, aprons, Passenger terminals-terminal sizing and configuration. Airport demand, capacity and delay.

UNIT - V

AIRSPACE: Categories of airspace, separation minima, airspace sectors, capacity, demand and delay. Evolution of air traffic control system procedural ATC system, procedural ATC with radar assistance, first generation 'automated' ATC system, current generation radar and computer-based ATC systems. Aerodrome air traffic control equipment and operation - ICAO future air-navigation systems (FANS). Air-navigation service providers as businesses.

TEXT BOOKS:

1. Mike Hirst (2008), *The Air Transport System*, Cambridge Woodhead Publishing Ltd, USA.

REFERENCE BOOKS:

1. John G Wensveen (2008), *Air Transportation: a Management Perspective*, 6th edition, Ashgate, New Delhi.
2. Peter Belobaba, Amedeo R. Odoni and Cynthia Barnhart (2009), *Global Airline Industry*, Wiley, USA.
3. Massoud Bazargan(2010), *Airline Operations and Scheduling*, 2nd edition , Ashgate, New Delhi.
4. Michael S Nolan (2011), *Fundamentals of Air Traffic Control*, 5th edition, Delmar Cengage Learning, New York.
5. Seth B. Young, Alexander Wells(2011), *Airport Planning and Management*, 6th edition, McGraw-Hill, New Delhi.

B. Tech. AE V SEMESTER

AEROSPACE PROPULSION - I

Course Code: **A1711**

L	T	P	C
4	-	-	4

UNIT - I

FUNDAMENTALS OF GAS TURBINE ENGINES: Illustration of working of gas turbine engine. The thrust equation, Factors affecting thrust, Effect of pressure, velocity and temperature changes of air entering compressors. Method of thrust augmentation. Characteristics of turboprop, turbojet, Performance characteristics.

UNIT - II

SUBSONIC INLETS: Internal flow and Stall in Subsonic inlets, Boundary layer separation. Major features of external flow near a subsonic inlet. Relation between minimum area ratio and eternal deceleration ratio. Diffuser performance.

SUPERSONIC INLETS: Supersonic inlets, starting problem in supersonic inlets, Shock swallowing by area variation, External deceleration. Modes of inlet operation.

UNIT - III

COMBUSTION CHAMBERS AND PERFORMANCE: Classification of combustion chambers, important factors affecting combustion chamber design, Combustion process, Combustion chamber performance.

PERFORMANCE SENSITIVITY: Effect of operating variables on performance, Flame tube cooling, Flame stabilization. Use of flame holders, Numerical problems.

UNIT - IV

NOZZLES: Theory of flow in isentropic nozzles, Convergent nozzles and nozzle choking, Nozzle throat conditions. Nozzle efficiency, Losses in nozzles. Over-expanded and under-expanded nozzles, Ejector and variable area nozzles, Interaction of nozzle flow with adjacent surfaces, Thrust reversal.

UNIT - V

CENTRIFUGAL COMPRESSORS: Principle of operation of centrifugal compressors. Work done and pressure rise - Velocity diagrams, Diffuser vane design considerations. Concept of Prewhirl, Rotating stall.

AXIAL FLOW COMPRESSORS: Elementary theory of axial flow compressor, Velocity triangles, Degree of reaction, three dimensional flow. Air angle distribution for free vortex and constant reaction designs, Compressor blade design. Centrifugal and Axial compressor performance characteristics.

TEXT BOOKS:

1. Ronald D. Flack (2010), *Fundamentals of Jet Propulsion with Application*, Cambridge University Press, USA.
2. H. I. H. Saravanamuttoo, Cohen H. Rogers (2009), *Gas Turbine Theory*, 6th edition, Pearson Education, New Delhi, India.
3. V. Ganesan (2010), *Gas Turbines*, Tata McGraw-Hill, New Delhi, India.

REFERENCE BOOKS:

1. Oates G. C (1986), *AeroThermodyanamics of Aircraft Engine Components*, AIAA Education Series, USA.
2. Rolls- Royce (2005), *Jet Engine*, 6th edition, Rolls - Royce Ltd, USA.
3. A. S. Burack (2011), *Gas Turbines and Jet and Rocket Propulsion*, Goldberg Press, New York.
4. Saeed Farokhi (2009), *Aircraft Propulsion*, 2nd edition, John Wiley, USA.

B. Tech. AE V SEMESTER

AERODYNAMICS - II

Course Code: **A1712**

L	T	P	C
3	1	-	4

UNIT - I

ONE DIMENSIONAL FLOWS: Isentropic process for closed system/flow processes. Velocity of sound. Mach number, flow regimes. Governing equations of inviscid compressible flow. Continuity, Momentum and Energy equations in Integral and Differential form. Stagnation conditions.

UNIT - II

FLOW THROUGH NOZZLES: Isentropic flow through Convergent – Divergent nozzles. Chocked flow conditions. Normal shock. Under and over expansion conditions. Flow through diffusers, wave reflections from a free boundary. Description of supersonic wind tunnels and rocket engine.

UNIT - III

OBLIQUE SHOCKS AND EXPANSION WAVES: Oblique shock relations. Super sonic , M relations strong and weak shock solutions / Shockflow over a wedge polar. Regular reflection from a solid boundary. Intersections of shock wave. Expansion waves. Prandtl – Meyer Expansion.

SUBSONIC COMPRESSIBLE FLOW OVER AIRFOIL: Introduction, Velocity potential equation, Transonic small perturbation equation, Prandtl-Glauert compressibility corrections, Critical Mach number, Drag divergence Mach number, Area rule, Supercritical airfoil.

UNIT - IV

SUPERSONIC FLOW: Linearized supersonic flow, Linearized supersonic flow over airfoil and wings. Shock Expansion theory. Detached shock. Axi-symmetrical flows, flow past slender bodies of revolution, conical flows, Numerical integration procedure.

HYPERSONIC FLOWS: Qualitative aspects of hypersonic flow. Newtonian theory. Flat plate at an angle of attack. Hypersonic shock wave relations. Lift and drag of wings at hypersonic speeds. Recent advances in hypersonic flows and testing techniques.

UNIT - V

FLOW MEASUREMENTS AND MODEL TESTING: Non dimensional parameters and II numbers Similarity of flows. Model testing in wind tunnels. Pressure, Velocity measurements, Hotwire and Laser, Doppler anemometer, Turbulence measurements. Measurement errors. Test section speed, horizontal buoyancy, flow angularities.

FORCE MEASUREMENTS WIND TUNNEL BALANCES: Force measurements, Wind tunnel balances. Scale effects and corrections, wall interferences, induced drag and other computations/corrections.

TEXT BOOKS:

1. Anderson J .D. (2011), *Fundamental of Aerodynamics*, 5th edition, McGraw-Hill, New Delhi.
2. Rathakrishnan E.E. (2010), *Gas Dynamics*, 3rd Edition, Prentice Hall of India, New Delhi.

RFFERENCE BOOKS:

1. Anderson J .D (2004), *Modern Compressible Fluid Flow*, 3rd Edition, McGraw-Hill International Edition, New York
2. Hodge B. K, Koenig K (1995), *Compressible Fluid Dynamics with Computer Application*, 1st edition, Prentice Hall, New York.
3. Clancy L. J. (2006), *Aerodynamics*, Sterling Publishers, New Delhi.

B. Tech. AE V SEMESTER

FLIGHT MECHANICS - II

Course Code: **A1713**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION: Degree of freedom of a system, Static and dynamic stability. Need for stability in an airplanes. Purpose of controls, inherently and marginally stable airplanes.

EQUATIONS OF MOTION: Equations of motion of a rigid body. Inertial forces and moments. Equations of motion of flight vehicles. Aerodynamic forces and moments. Decoupling of longitudinal and lateral-directional equations. Linearization of equations.

UNIT - II

AERODYNAMIC STABILITY DERIVATIVES: Aerodynamic stability and control derivatives. Relation to geometry, flight configuration. Effects of power, compressibility and flexibility.

UNIT - III

STATIC LONGITUDINAL STABILITY - CONTROL FREE: Effects of releasing the elevator. Hinge moment coefficients, Control forces to trim. Control free neutral point - Trim tabs. Aerodynamic balancing of control surfaces. Means of augmentation of control.

MANEUVER STABILITY: Contribution of pitch damping to pitching moment of flight vehicle, Effect on trim and stability. Control deflections and control forces for trim in symmetric maneuvers and coordinated turns. Control deflection and force gradients. Control fixed and control free maneuver stability. Maneuver points. Maneuver margins.

UNIT - I V

STATIC LONGITUDINAL STABILITY AND CONTROL - CONTROL FIXED: *Stick Fixed*: Basic equilibrium equation, Stability criterion, Contribution of wing and tail and elevator to pitching moments. Effect of fuselage and nacelles, Effects of center of gravity location, Power effects Stabilizer setting and center of gravity location, Elevator power, Elevator to trim . Trim gradients. Control fixed static stability, Control fixed neutral point. Stability margins.

UNIT - V

STATIC LATERAL AND DIRECTIONAL STABILITY AND CONTROL: Dihedral effect, Coupling between rolling and yawing moment, Adverse yaw, Aileron power, Aileron reversal. Weather cocking effects, Rudder power. Lateral and directional stability- definition. Control surface deflections in steady sideslips, rolls and turns one engine inoperative conditions, Rudder lock.

DYNAMIC STABILITY AND RESPONSE TO CONTROL: Solutions to the stability quadratic of the linearised equations of motion. The principal modes. Phugoid , Short Period Dutch Roll and Spiral modes, Further approximations. Restricted degrees of motion. Solutions. Response to controls. Auto rotation and spin.

TEXT BOOKS:

1. Houghton E. L, Carruthers N. B. (2010), *Aerodynamics for Engineering Students*, 5th edition, Elsevier, USA.
2. Mc. Cormic B. W. (2010), *Aerodynamics, Aeronautics and Flight Mechanics*, Wiley India Pvt. Ltd, USA.

REFERENCE BOOKS:

1. Perkins C. D, Robert Hage E (2003), *Airplane Performance, Stability and Control*, Wiley Toppan, USA.
2. Nelson R. C (2007), *Flight Stability and Automatic Control*, SIE edition, McGraw Hill, New York.
3. T. R. Yechout, S. L. Morns (2003), *Introduction to Aircraft Flight Mechanics*, AIAA Publishers, USA.

B. Tech. AE V SEMESTER

AEROSPACE VEHICLE STRUCTURES - II

Course Code: **A1714**

L	T	P	C
3	1	-	4

UNIT - I

LOAD DIFFISION IN STIFFNED PANELS: Wagner's theory of beams. Shear carrying capabilities of panels and introduction to Tension field webs. Semi tension and complete tension field beams. Minocqua and semi Minocqua structures.

SHEET STRINGER COMBINATIONS: Axial Load flow diagrams for boom in stiffened panels. Simple illustrative examples of A/C sheet stringer elements through free body diagrams. Load diffusion in thin walled panels with oblique stiffeners.

UNIT - II

STRESS ANALYSIS OF WING AND FUSELAGE: Procedure - Shear and bending moment distribution for semi cantilever and other types of wings and fuselages - Thin webbed beam with parallel and non parallel flanges, Shear resistant web beams.

UNIT - III

STABILITY OF PANELS: Stability of stiffened panels. Effective width concept. Simple estimations of load carrying capability of stressed skins of Aircraft wing shells.

SHEAR FLOW IN OPEN SECTIONS SUBJECTED TO PURE BENDINGS: Thin walled beams, Shear centre and Elastic axis Concept of shear flow beams with one axis of symmetry, Unsymmetrical box beam with effective and ineffective skins.

UNIT - IV

TORSION BENDING OF OPEND TUBES: Torsion bending phenomena. Torsion bending constant and specific torsion bending strength Simple derivation of torsion bending equation. The phenomena of warping. Stresses in cantilever, I-beam by solution of general differential equation for torsion beam.

UNIT - V

INHIBITION OF AXIL CONSTRAINT STRESS: Torsion of thin walled beams with open sections effect of axial constraints. Primary and Secondary warping phenomena. Computation of torsion bending constant for open tubes with cross sections such as Channel, T and Angle.

AIRCRAFT SKIN STIFFNERS: Methods of improving torsion bending strength by lipping, as an effective means of improving torsion bending constant. Computation of improvement of specific torsion bending strength in lipped Channel, T, I, L, sections over the unclipped counter parts

TEXT BOOKS:

1. Megson T. H. G (2012), *Aircraft Structures for Engineering Students*, 5th edition, Elsevier, USA.
2. David J. Perry (2011), *Aircraft Structures*, 2nd Edition, McGraw- Hill, New Delhi.

REFRENCE BOOKS:

1. Irving Herman Shames, Clive L. Dym(2003), *Energy and finite element methods structural analysis,* McGraw-Hill, New Delhi.
2. B. C. Punmia (2011), *Theory of Structures*, 13th edition, Laxmi Publication, Hyderabad.
3. Donaldson B. K.(2008), *Analysis of Aircraft Structures An introduction to Aeronautical Structures Analysis*, 2nd Edition, Cambridge University Press, USA.

B. Tech. AE V SEMESTER

INTRODUCTION TO SPACE TECHNOLOGY

Course Code: **A1715**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION: Space Mission, Types, Space Environment, Launch Vehicle Selection.

UNIT - II

FUNDAMENTALS OF ROCKET PROPULSION: Introduction to rocket propulsion, fundamentals of solid propellant rockets, Fundamentals of liquid propellant rockets. Rocket equation.

UNIT - III

ASCENT FLIGHT MECHANICS OF ROCKETS AND MISSILES: Two-dimensional trajectories of rockets and missiles. Multi-stage rockets, Vehicle sizing. Two stage Multi-stage Rockets, Trade-off Ratios-Single Stage to Orbit, Sounding Rocket-Aerospace Plane, Gravity Turn Trajectories-Impact point calculation, Injection conditions, Flight dispersions.

ATMOSPHERIC REENTRY: Introduction, Steep Ballistic Reentry, Ballistic Orbital Reentry, Skip Reentry, "Double- Dip" Reentry, Aero-braking, Lifting Body Reentry.

UNIT - IV

FUNDAMENTALS OF ORBITAL MECHANICS: Two-body motion-Circular, elliptic, hyperbolic, and parabolic orbits. Basic Orbital Elements, Ground Trace.

ORBITAL MANEUVERS: In-Plane Orbit changes, Hohmann Transfer, Bielliptical Transfer, Plane Changes, Combined Maneuvers, Propulsion for Maneuvers.

UNIT - V

SATELLITE ATTITUDE DYNAMICS: Torque free Axi-symmetric rigid body, Attitude Control for Spinning Spacecraft. Attitude Control for Non-spinning Spacecraft. The Yo-Yo Mechanism, Gravity, Gradient Satellite. Dual Spin Spacecraft, Attitude Determination.

SPACECRAFT POWER AND COMMUNICATION SYSTEMS: Spacecraft Power, Telecommunications.

TEXT BOOKS:

1. W. E. Wiesel (2010), *Spaceflight Dynamics*, 3rd edition, McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. J. Sellers (2005), *Understanding Space: An Introduction to Astronautics*, 3rd edition, McGraw- Hill, New Delhi.
2. Francis J. Hale (1994), *Introduction to Space Flight*, 1st edition, Prentice-Hall, New York.
3. D. Brown Charles (1998), *Spacecraft Mission Design*, 2nd edition, AIAA Education Series, USA.
4. Meyer Rudolph X (1999), *Elements of Space Technology for Aerospace Engineers*, Academic Press, New York.

B. Tech. AE V SEMESTER

AIRCRAFT PRODUCTION TECHNOLOGY LAB

Course Code: **A1716**

L	T	P	C
-	-	3	2

Basic Exercises in Lathe, Shaper, Milling, Slotting, EDM, CNC and Grinding machines welding equipment and metallurgy equipment comprising Microscopes polishing disc grinders as under.

PRODUCTION LAB:

1. Plain Turning, Taper turning, Facing, Knurling, Thread Cutting.
2. Drilling, boring, counter boring, counter sinking
3. Shaping and planning of square blocks, V-ways and Dovetail ways
4. Plain Milling
5. Gear Milling
6. Cylindrical Grinding / Surface Grinding
7. Simple exercises in EDM
8. Sheet metal joining by rivets Soldering and brazing.
9. Simple exercises on CNC machines and Programme generation.
1. 10.Simple exercises in Solid State Welding, Gas Welding and Arc Welding.
10. Metal joining Techniques (Brazing and Soldering).

MATERIALS LAB:

1. Aircraft wood gluing practice
2. Study of properties of sandwich structures
3. Study of Micro Structures of Non ferrous alloys
4. Experiment on Autoclave for different geometrical structures

REFERENCE BOOKS:

1. Keshu S. C, Ganapathy K. K (2011), *Air craft production techniques*, E-book, Interline Publishing House, New York, USA.
2. Kalpakajian Serope (2011), *Manufacturing Engineering and Technology*, 5th edition, Pearson Education, London.

B. Tech AE V SEMESTER

AEROSPACE VECHILE STRUCTURES LAB

Course Code: **A1717**

L	T	P	C
-	-	3	2

LIST OF EXPERIMENTS:

1. Tensile testing using universal Testing Machine - Mechanical and optical Extensometers, Stress - strain curves and strength tests for various engineering materials.
2. Bending tests: Stress and deflection of beams for various end conditions. Verification of Maxwell's and Castiglianos theorems, Influence coefficients.
3. Compression tests on long and short columns, Critical buckling loads, South well plot.
4. Test on riveted and bolted joints.
5. Test using NDT inspection method.
   Strain gauge techniques, Measurement of strain in beams, thin and thick walled cylinders subjected to internal pressure, Shaft subjected to combined loading.
6. Shear centre in open and closed sections beams, Test on semi-tension field beams.
7. Elastic constants for composite materials, Flexural test on composites.
8. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
9. Study and use of a Seismic pickup for the measurement of vibration amplitude.
10. Critical Fracture toughness of Aerospace material

TEXT BOOKS:

1. Megson T. H. G (2012), *Aircraft Structures for Engineering Students*, 5th edition, Elsevier, USA.
2. David J. Perry (2011), *Aircraft Structures*, 2nd Edition, McGraw- Hill, New Delhi.

REFRENCE BOOKS:

1. Irving Herman Shames, Clive L. Dym (2003), *Energy and finite element methods structural analysis,* McGraw Hill, New Delhi.
2. B. C. Punmia (2011), *Theory of Structures*, 13th edition, Laxmi Publications, New Delhi.
3. Donaldson B. K (2008), *Analysis of Aircraft Structures An introduction to Aeronautical Structures Analysis*, 2nd edition, Cambridge University Press, London.

EQUIPMENT NEEDED:

1. UTM – 20 / 40 Tons with. Jigs and Fixtures and precision Extensometers
2. Deflection test rig (Fabricated hardware + precession dial gauge)
3. Shear center Test rig
4. NDT Equipment
   a. Ultrasonic apparatus
   b. Magnetic Particle test rig
   c. Dye penetration test
5. Strain Measuring equipment
   a. Wheat stone Bridge
   b. Multi channel strain measuring equipment
   c. Various gauges / rosettes
6. Various Hardware rigs desired in the lab for specific test.

SYLLABI FOR VI SEMESTER

B. Tech AE VI SEMESTER

CONTROL SYSTEMS

Course Code: **A1212**

L	T	P	C
3	1	-	4

UNIT - I

BASICS IN CONTROL SYSTEM AND TRANSFER FUNCTION: Introduction of Control Systems , Various types of systems (Open Loop and closed loop) and their differences- Classification and Feed-Back Characteristics of control system- Effects of feedback. Mathematical models – Differential equations, Translational and Rotational mechanical systems. Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver.

UNIT - II

REPRESENTATION OF TRANSFER FUNCTION AND CONTROL DESIGN TECHNIQUES: Block diagram representation of systems considering electrical systems as examples. Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula. Compensation techniques – Lag, Lead, Lead-Lag Controllers design, PID Controllers.

UNIT - III

TIME RESPONSE ANALYSIS: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

STABILITY ANALYSIS: The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT - IV

FREQUENCY RESPONSE ANALYSIS: Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

STABILITY ANALYSIS IN FREQUENCY DOMAIN: Polar Plots-Nyquist Plots-Stability Analysis

UNIT - V

STATE SPACE ANALYSIS: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties - Concepts of Controllability and Observability

TEXT BOOKS:

1. I. J. Nagrath, M .Gopal (2011), *Control Systems Engineering*, 5th edition, New Age International (P) Limited, New Delhi, India.
2. Benjamin. C. Kuo (2003), *Automatic Control Systems*, 8th edition, John Wiley and Son's, USA.

REFERENCE BOOKS:

1. K. Ogata (2008), *Modern Control Engineering*, 4th edition, Prentice Hall of India Pvt. Ltd, New Delhi.
2. N. K. Sinha (2008), *Control Systems*, 3rd edition, New Age International Limited Publishers, New Delhi.

B. Tech. AE VI SEMESTER

OPERATIONS RESEARCH
(Common to AE & CE)

Course Code: **A1330**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION TO OPERATIONS RESEARCH: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem, Formulation and Graphical solution of Linear Programming Problem. Simplex Method, Artificial variables Techniques, big -M method, two -phase simplex method, degeneracy and unbound solutions.

UNIT - II

TRANSPORTATION PROBLEM: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions, North-West corner rule, least cost method and Vogel's approximation method. Optimality test - MODI method.

ASSIGNMENT MODEL: Formulation, Hungarian method for optimal solution, solving unbalanced problem, Traveling salesman problem as assignment problem.

UNIT - III

SEQUENCING MODELS: Solution of Sequencing Problem, Processing n Jobs through two machines, Processing n Jobs through three machines, Processing two Jobs through m machines, Processing n Jobs through m Machines.

QUEUING THEORY: Introduction, Single Channel, Poisson arrivals, exponential service times with infinite population and finite population models.

UNIT - IV

REPLACEMENT MODELS: Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value, Replacement of items that fail suddenly, individual replacement policy, group replacement policy.

INVENTORY MODELS: Inventory costs, Models with deterministic demand model: (a) Demand rate uniform and production rate infinite, (b) Demand rate non-uniform and production rate infinite, (c) Demand rate uniform and production rate finite.

UNIT - V

GAME THEORY: Competitive game, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle, Rectangular games without saddle point, mixed strategy for 2 X 2 games.

DYNAMIC PROGRAMMING: Characteristics of dynamic programming, Dynamic programming approach for priority management employment smoothening, Capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.

TEXT BOOKS:

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi (2006), *Operations Research*, Pearson Education, India.
2. S. D. Shama (2009), *Operation Research,* Tata McGraw Hill, New Delhi.

REFERENCE BOOKS:

1. J. K. Sharma (2007), *Operations Research – Theory and Applications,* 3rd edition, Macmillan India Ltd, India.
2. R. Panneerselvam (2008), *Operations Research*, 2nd edition, Prentice Hall of India, India.
3. F. S. Hillier, G. J. Lieberman (2007), *Introduction to Operations Research,* 8th edition, Tata McGraw Hill, New Delhi, India.

B. Tech. AE VI SEMESTER

AEROSPACE PROPULSION - II

Course Code: **A1718**

L	T	P	C
4	-	-	4

UNIT - I

GAS TURBINE THEORIES: Impulse and reaction balding of gas turbines, Velocity triangles and power output, Elementary theory, Vortex theory. Choice of blade profile, pitch and chord, Estimation of stage performance.

DESIGN CONSILRETIONS: Limiting factors in gas turbine design, Overall turbine performance. Methods of blade cooling, matching of turbine and compressor, Numerical problems.

UNIT - II

THRUST CONTROL: Thrust Augmentation through after burning, thrust vector control methods.

RAMJET PROPULSION: Operating principle Subcritical, critical and supercritical operation. Combustion in ramjet engine, Ramjet performance, Sample ramjet design calculations. Introduction to SCRAMJET, Preliminary concepts in supersonic combustion, Integral ram, Rocket, Numerical problems.

UNIT - III

CHEMICAL ROCKETS: *Solid Propellant:* Solid propellant rockets, Selection criteria of solid propellants, important hardware components of solid rockets, Propellant grain design considerations.

LIQUID PROPELLANT: Liquid propellant rockets, cooling in liquid rockets. Limitations of hybrid rockets, Relative advantages of liquid rockets over solid rockets.

UNIT - IV

FUNDAMENTALS OF ROCKET PROPULSION: Operating principle, Specific impulse of a rocket, internal ballistics, Rocket nozzle classifications. Rocket performance considerations, Numerical problems.

UNIT - V

ADVANCED PROPULSION TECHNIQUES: Electric rocket propulsion, Ion propulsion techniques, nuclear rocket - Types, Solar sail, Preliminary concepts in nozzle less propulsion.

TEXT BOOKS:

1. Sutton G. P. (2010), *Rocket Propulsion Elements*, 8th edition, John Wiley & Sons Inc, USA.
2. Philipa Hill, Carl Peterson (2010), *Mechanics and Thermodynamics of Propulsion*, 2nd edition, Addison Wesley Longman Inc, USA.

REFERENCE BOOKS:

1. Oates G. C (1986), *Aero Thermodyanamics of Aircraft Engine Components*, AIAA Educational Series, USA.
2. Rolls- Royce (2005), *Jet Engine*, 6th edition, Rolls - Royce Ltd, USA.
3. Ganesan V (2010), *Gas Turbines*, Tata McGraw- Hill, New Delhi.
4. S. M. Yahya(2010), *Fundamentals of Compressible Flow with Aircraft and Rocket propulsion*, 4th Edition, New Age International Publications, New Delhi.

B. Tech. AE VI SEMESTER

FLIGHT VEHICLE DESIGN

Course Code: **A1719**

L	T	P	C
3	1	-	4

UNIT - I

OVERVIEW OF THE DESIGN PROCESS, SIZING FROM A CONCEPTUAL SKETCH: Phases of aircraft design. Aircraft conceptual design process, project brief / request for proposal, problem definition, information retrieval, aircraft requirements, configuration options. Integrated product development and aircraft design. The initial conceptual sketches, L / D estimation. Initial takeoff weight build-up, empty weight estimation, historical trends, fuel fraction estimation, mission profiles, mission segment weight fractions.

UNIT - II

AIRFOIL AND GEOMETRY SELECTION, THRUST TO WEIGHT RATIO, WING LOADING: Airfoil selection, airfoil design, design lift coefficient, stall, airfoil thickness ratio and other airfoil considerations. Wing geometry and wing vertical location, wing tip shapes. Tail geometry and arrangements. Thrust to weight ratio, statistical estimation, thrust matching. Wing loading performance constraints. Selection of thrust-to-weight ratio and wing loading.

INITIAL SIZING AND CONFIGURATION LAYOUT, CREW STATION, PASSENGERS AND PAYLOAD: Sizing with fixed engine and with rubber engine. Geometry sizing of fuselage, wing, tail, control surfaces. Development of configuration lay out from conceptual sketch. The inboard profile drawing, wetted area, volume distribution and fuel volume plots. Lofting- definition, significance and methods, flat wrap lofting. Special consideration in configuration lay out. Isobar tailoring, Sears-Haack volume distribution, structural load paths. Radar, IR, visual detectability, aural signature. Considerations of vulnerability, crashworthiness, producibility, maintainability. Fuselage design, crew station, passenger compartment, cargo provisions, weapons carriage, gun installation.

UNIT - III

PROPULSION AND FUEL SYSTEM INTEGRATION, LANDING GEAR AND SUBSYSTEMS: Propulsion selection, jet engine integration, engine dimensions, inlet geometry, inlet location, capture area calculation, boundary layer diverters, nozzle integration, engine cooling provisions, engine size estimation. Fuel system design and integration. Landing gear arrangements, guidelines for lay out. Shock absorbers–types, sizing, stroke determination, gear load factors. Gear retraction geometry. Aircraft subsystems, significance to configuration lay out. The baseline design layout and report of initial specifications.

BASELINE DESIGN ANALYSIS- AERODYNAMICS & PROPULSION, STRUCTURES & WEIGHT AND BALANCE: Estimation of lift curve slope, maximum lift coefficient, complete drag build up. Installed performance of an engine, installed thrust methodology, net propulsive force, part power operation. Aircraft loads, categories: maneuver, gust, inertial, power plant, landing gear loads. Limit loads, the V, n diagram. Air load distribution on lifting surfaces. Review of methods of structural analysis. Material selection. Weights and moments statistical group estimation method, centre of gravity excursion control.

UNIT - IV

BASELINE DESIGN - STABILITY AND CONTROL, PERFORMANCE AND CONSTRAINT ANALYSIS: Estimation of static pitch stability, velocity stability and trim. Estimation of stability and control derivatives. Static lateral, directional stability and trim. Estimation of aircraft dynamical characteristics, handling qualities. Cooper – Harper scale, relation to aircraft dynamic characteristics. Performance analysis and constraint analysis– steady level flight, minimum thrust required for level flight, range and loiter endurance. Steady climbing and descending flight, best angle and rate of climb, time to climb and fuel to climb. Level turning flight, instantaneous turn rate, sustained turn rate. Energy maneuverability methods of optimal climb trajectories and turns. The aircraft operating envelope. Take off analysis, Balanced field length. Landing analysis. Fighter performance measures of merit. Effects of wind on aircraft performance. Initial technical report of baseline design analysis and evaluation. Refined baseline design and report of specifications.

COST ESTIMATION, PARAMETRIC ANALYSIS, OPTIMISATION, REFINED SIZING AND TRADE STUDIES: Elements of life cycle cost, cost estimating method, RDT&E and production costs, operation and maintenance costs, fuel and oil costs, crew salaries, maintenance expenses, depreciation. Cost measures of merit. Aircraft and airline economics, DOC and IOC, airline revenue, breakeven analysis, investment cost analysis. Parametric analysis and optimisation. Refined conceptual sizing methods. Sizing matrix plot and carpet plot. Trade studies, design trades, requirement trades, growth sensitivities. Multivariable design optimization methods. Measures of merit. Determination of final baseline design configuration, preparation of type specification report.

UNIT - V

CASE STUDIES AND DESIGN OF UNIQUE AIRCRAFT CONCEPTS: Design of the DC – 1, DC – 2, DC- 3 aircraft, Boeing B-47 and 707, General Dynamics F-16, SR-71 Blackbird, Northrop-Grumman B-2 Stealth Bomber. A survey of the Indian aircraft design effort. Design of VTOL aircraft, helicopters, hypersonic vehicles, delta and double delta wings, forward swept wings, uninhabited air vehicles.

TEXT BOOKS:

1. Raymer, Daniel P. (2006), *Aircraft Design: A Conceptual Approach*, 4th edition, AIAA Educational Series, USA.
2. J. F. Marchman, L. R. Jenkinson (2003), *Aircraft Design Projects for Engineering students*, AIAA Publishers, USA.
3. Ajoy Kumar Kunda (2010), *Aircraft Design,* Cambridge University Press, UK.

REFERENCE BOOKS:

1. Torenbeek E. (1986), *Synthesis of Subsonic Airplane Design*, Delft University Press, New York.
2. Bruhn. E. H (1973), *Analysis and Design of Flight Vehicles Structures*, New Edition, Jacobs Publishing House, USA.
3. Scheler E. E, Dunn L.G (1963), *Airplane Structural Analysis and Design*, John Wiley & Sons, USA.
4. D. Howe (2005), *Aircraft conceptual Design Synthesis,* John Wiley & Sons Publishers, USA.

B. Tech. AE VI Semester

FINITE ELEMENT MODELING AND ANALYSIS

Course Code: **A1720**

L	T	P	C
3	1	-	4

UNIT - I

MODELS: Macro and Micro mechanical models and Basis of the Finite Element-formulations for developing and specification structural models. Equilibrium and energy bases for designing such as stiffness, flexibility, Inertia, damping and stability characteristics. Degrees of freedom and their relevance's to approximate methods of analysis

GENERELIZED COORDINATES: Introduction to generalized coordinates and their classification based frames of reference (local/global), nature and utility. Field specific nature of such coordinates in time and space for representing both continuua and discontinua. Non dimensional coordinates, Area and Volume coordinates, utility of generalized coordinates in respresenting continuum and discrete systems.

UNIT - II

DISCRETIZATION: Role of interpolation (Hermitian and Langragian) functions in discretization, concepts of nodes and elements in discretizing 1-D and 2-D Solid fluid continuua. Examples of discretization of heat conduction shear axial, Torsional and Bending deformations of constant and stepped 1-D structures. Discretization of plane stress Plain strain and 3-D space frame problems

UNIT - III

PROPERTIES AND DERIVATION: Derivation of element property matrices from first principles, energy basis for deriving stiffness, mass element properties, Assembly Technique, Concept of work done and derivation of kinematically consistent load vectors Direct deduction of matrix equation of equilibria using assembly technique for property derivation for 1-D structures and frames.

APPROXIMATIONS AND ERROR CONTROL: Nodal parametric representation of discrete domains and fields. Isoparametric, Subparametric and Superparametric representation. Injection of singularity in field distortions and their utility in fracture mechanics.

UNIT - IV

MATHEMATICAL TOOLS AND FEM TOOLS: Importance of designing codes in discretizing. Illustration of 1-D and 2-D field problems. Basics of Numerical integration and Gauss quadrature. Techniques of data storage and solution of storage of large scale matrices. Concept of bandwidth and Front widths and their minimization. In core, and out of core solution of based on matrices. Frontal techniques.

UNIT - V

CONCEPTS OF SYMMETRY: Symmetries in 1-D, 2-D Structures including Axisymmetry. Symmetry Operations and Symmetry boundary conditions for fractional models in Analysis

MESH GENERATION TECHNIQUES: Using Commercial software's such as ANSYS, NISA, NASTRAN, ASKA, CAEFEM etc.

TEXT BOOKS:

1. S. S. Rao (2012), *The Finite Element Methods in Engineering*, Elsevier, USA.

REFERENCES BOOKS:

1. Segarlind L. J (2011), *Applied Finite Element Analysis*, Wiley India Limited, New York.
2. Desai C. S, Abel J. F(2001) , *An introduction to the Finite Element Method*, CRC Press, New Delhi.
3. Bathe K. J, Wilson E. L (1985), *Numerical Methods in Finite Element Analysis*, Prentice Hall of India, New Delhi.
4. Daryl Logan (2007), *A first course in the Finite Element Method*, Nelson Engineering Publishers, New Delhi.

B. Tech. AE VI SEMESTER

AIR POLLLUTION AND CONTROL METHODS

Interdepartmental Elective - I
(Common to AE, EEE & ME)

Course Code: **A1148**

L	T	P	C
4	-	-	4

UNIT - I

AIR POLLUTION: Definitions, scope, significance and episodes, air pollutants – classifications - natural and artificial - primary and secondary, point and non- point, line and areal sources of air pollution- stationary and mobile sources. Effects of air pollutants on man, material and vegetation: global effects of air pollution - green house effect, heat islands, acid rains, ozone holes etc.

UNIT - II

THERMODYNAMICS AND KINETICS OF AIR - POLLUTION: Applications in the removal of gases like SOx, NOx, CO, HC etc., air-fuel ratio. Computation and Control of products of combustion. Meteorology and plume Dispersion,

UNIT - III

PROPERTIES OF ATMOSPHERE: Heat, Pressure, Wind forces, Moisture and relative Humidity, Influence of Meteorological phenomena on Air Quality-wind rose diagrams.

LAPSE RATES: Pressure Systems, Winds and moisture plume behavior and plume Rise Models; Gaussian Model for Plume Dispersion.

UNIT - IV

CONTROL OF PARTICULATES: Control at Sources, Process Changes, Equipment modifications, Design and operation of control. Equipment's – Settling Chambers, Centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators. General Methods of Control of NOx and Sox emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling.

UNIT - V

AIR QUALITY MANAGEMENT: Monitoring of SPM, SO; NO and CO Emission Standards.

TEXT BOOKS:

1. M. N. Rao, H. V. N. Rao (1988), *Air pollution*, Tata McGraw Hill Education, New Delhi, India.
2. C. S. Rao (2006), *Environmental Pollution control Engineering*, New age international, New Delhi, India.

REFERENCE BOOKS:

1. R. K. Trivedy, P. K. Goel (2003), *Introduction to Air pollution*, ABD Publications, New Delhi, India.
2. Wark, Warner (1998), *Air pollution its origin and control,* Addison-Wesley, New York.

B .Tech. AE VI SEMESTER

SATELLITE AND RADAR COMMUNICATIONS

(Interdepartmental Elective - I)

Course Code: **A1441**

L	T	P	C
4	-	-	4

UNIT - I

ORIGIN OF SATELLITE COMMUNICATIONS: Historical Background, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

SATELLITE SUBSYSTEMS: Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.

UNIT - II

SATELLITE LINK DESIGN: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

MULTIPLE ACCESSES: Frequency division multiple access (FDMA) Inter modulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Code Division Multiple access (CDMA).

UNIT - III

EARTH STATION TECHNOLOGY: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

INTRODUCTION TO RADAR: The Nature of Radar, Maximum unambiguous range, Radar waveforms, Simple form of Radar equation, Radar block diagram & Operation, Radar frequencies and applications, Related Problems.

UNIT - IV

RADAR EQUATION: Prediction of Range performance, Minimum detectable signal, Receiver Noise & SNR, Integration of Radar pulses, PRF & Range Ambiguities, System losses, Related Problems.

CW AND FREQUENCY MODULATED RADAR: Doppler Effect, CW Radar, Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, FM-CW Radar-Range and Doppler Measurement, FM-CW altimeter.

UNIT - V

MTI AND PULSE DOPPLER RADAR: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter. Delay Line Cancellers, Filter Characteristics, Blind Speeds, Double Cancellation, MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler Radar.

TRACKING RADAR: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar - Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse.

TEXT BOOKS:

1. Timothy Pratt (2003), *Satellite Communications,* 2nd edition, Wiley Publications, India.
2. Merill I. Skolnik (2007), *Introduction to Radar Systems*, 2nd edition, Tata McGraw-Hill, India.

REFERENCE BOOKS:

1. M. Richharia (2003), *Satellite Communications: Design Principles*, 2nd edition, BS publications, India.
2. Dennis Roddy (2006), *Satellite Communications*, 2nd edition, Tata McGraw-Hill, India.
3. Merill I. Skolnik (2001), *Introduction to Radar Systems*, 3rd edition, Tata McGraw-Hill, India.

B. Tech. AE VI SEMESTER

DIGITAL ELECTRONICS AND MICROPROCESSORS

Interdepartmental Elective - I

(Common to AE, ME & CE)

Course Code: **A1453**

L	T	P	C
4	-	-	4

UNIT - I

BINARY SYSTEMS: Digital Computers and Digital Systems, Binary Numbers, Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes, Binary Storage and Registers, Binary Logic.

BOOLEAN ALGEBRA AND LOGIC GATES: Basic Definitions, Axiomatic definition of Boolean Algebra, Basic theorems and properties of Boolean algebra, Boolean functions canonical and standard forms, other logic operations, Digital logic gates.

UNIT - II

SIMPLIFICATION OF BOOLEAN FUNCTIONS: The map method, Two, three, four and five variable maps, product of sums simplification, NAND and NOR implementation, other Two-level implementations, Don't-care conditions, Tabulation method, determination and selection of prime implicants.

COMBINATIONAL LOGIC: Introduction, design procedure, Adders, Subtractors, magnitude comparator, Decoders, Encoders, Multiplexers, Demultiplexers, Code converters and Parity Generators.

UNIT - III

SEQUENTIAL LOGIC: Introduction, latches, Flip-Flops, truth tables and excitation tables, triggering OF flip-flops, Registers, shift Registers, Ripple counters, shift register counters (Ring, Johnson and LFSR Counters).

UNIT - IV

8085 MICROPROCESSOR: Introduction to microprocessors, Architecture of 8085, Pin Diagram of 8085, Timing Diagram, Addressing Modes, Instruction Set, Interrupt structure of 8085.

UNIT - V

MICROPROCESSOR PERIPHERAL INTERFACING: Methods of Interfacing I/O Ports: I/O Mapped I/O, Memory Mapped I/O, Programmable Peripheral interface 8255 – Various Modes of Operation and Interfacing to 8085, Need for DMA, DMA data transfer Method, Interfacing with DMA Controller 8257.

TEXT BOOKS:

1. M. Morris Mano (2012), *Digital Design,* 4th edition, Pearson Education/Prentice Hall of India, New Delhi, India.
2. Ramesh S. Goankar(2011), *Microprocessor Architecture, Programming and Applications with the 8085,* Prentice Hall of India, India.

REFERENCE BOOKS:

1. C. V. S. Rao (2010), *Switching Theory and Logic Design*, Pearson Education, India.
2. K. Uday Kumar, B. S. Uma Shankar (2008), *The 8085 Microprocessor Architecture, Programming and Interfacing*, Pearson Publications, India.

B. Tech. AE VI SEMESTER

CAD / CAM
(Interdepartmental Elective - I)

Course Code: **A1331**

L	T	P	C
4	-	-	4

UNIT - I

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT - II

GEOMETRIC MODELING: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

DRAFTING AND MODELING SYSTEMS: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

UNIT - III

NUMERICAL CONTROL: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

GROUP TECH: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

UNIT - IV

COMPUTER AIDED QUALITY CONTROL: Terminology in quality control, the computer in QC, contact inspection methods, non contact inspection methods-optical, non contact inspection methods-non optical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT - V

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

TEXT BOOKS:

1. A. Zimmers, P. Groover (2010), *CAD / CAM*, 3 rd edition, Prentice Hall of India, New Delhi.
2. Ibrahim Zeid(2011), *CAD / CAM Theory and Practice*, 4th edition, Tata McGraw Hill education (P) Ltd, New Delhi, India.

REFERENCE BOOKS:

1. P. Groover(2011), *Automation, Production systems and Computer integrated Manufacturing*, 3rd edition, Pearson Publications, India.
2. Radhakrishnan, Subramanian (2009), *CAD / CAM / CIM*, New Age Inetrnational Pvt. Ltd, New Delhi, India.
3. Alavala, C. R (2012), *CAD/CAM: Concepts and Applications*, 1st edition, Prentice Hall of India, New Delhi, India.

B. Tech. AE VI SEMESTER

ROBOTICS

Interdepartmental Elective – I

(Common to AE & EEE)

Course Code: **A1337**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics, an over view of Robotics, present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT - II

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation, problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics, problems.

UNIT - III

MANIPULATOR DYNAMICS - I: Differential transformation and manipulators, Jacobians, problems. Dynamics: Lagrange, Euler and Newton, Euler formations, Problems.

MANIPULATOR DYNAMICS - II: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion, straight line motion, Robot programming, languages and software packages.

UNIT - IV

ROBOT ACTUATORS AND FEEDBACK COMPONENTS: Actuators: Pneumatic, Hydraulic actuators, electric and stepper motors. Feedback components: position sensors, potentiometers, resolvers, encoders, Velocity sensors.

UNIT - V

ROBOT APPLICATION IN MANUFACTURING: Material Transfer, Material handling, loading and unloading, Processing spot and continuous arc welding & spray painting, Assembly and Inspection.

TEXT BOOKS:

1. M. P. Groover (2010), *Industrial Robotics*, 3rd edition, Pearson Education, New Delhi.
2. K. S. Fu (2010), *Robotics*, 1st edition, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS:

1. R.K. Mittal, I. J. Nagrath (2012), *Robotics and Control*, 1st edition, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
2. P. Coiffet, M. Chaironze (2010), *An Introduction to Robot Technology*, 3rd edition, Kogam Page Ltd., London.
3. Richard D. Klafter(2010), *Robotic Engineering*, 2nd edition, Prentice Hall of India, New Delhi.

B. Tech. AE VI SEMESTER

COMPOSITE MATERIALS

(Interdepartmental Elective - I)

Course Code: **A1338**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION: Definition, Classification of Composite materials based on structure based on matrix. Advantages of composites, application of composites, functional requirements of reinforcement and matrix.

UNIT - II

FIBERS: Preparation, properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers, properties and applications of whiskers, particle reinforcements.

UNIT - III

MANUFACTURING OF ADVANCED COMPOSITES: *Polymer matrix composites*: Preparation of Moulding compounds and prepregs, hand layup method, Autoclave method. Filament winding method, Compression moulding, Reaction injection moulding.

UNIT - IV

MANUFACTURING OF METAL MATRIX COMPOSITES: Casting, Solid State diffusion technique, Cladding - Hot isostatic pressing. *Manufacturing of Ceramic Matrix Composites:* Liquid Metal Infiltration, Liquid phase sintering. *Manufacturing of Carbon – Carbon composites*: Knitting, Braiding, Weaving.

UNIT - V

RESPONSE OF COMPOSITES TO STRESS: (a) Iso Strain condition (b) Iso Stress condition (c) Load friction shared by the fibers.

TEXT BOOKS:

1. V. C. H. Cahn (2007), *Materia*l *Science and Technology*, Vol. 13, 3rd edition, Wiley WCH, West Germany.
2. K. K. Chawla (2010), *Composite Materials,* 2nd edition*,* Springer*,* USA.

REFERENCE BOOKS:

1. E. D. Lubin (2003), *Hand Book of Composite Materials*, 3rd edition, Tata McGraw-Hill, New Delhi, India.
2. Muhammad M. Rafique (2009), *Composite Materials: Processing and Technology,* 2nd edition, Academy Press, Lap Lambert.
3. P. K. Sinha (2006), *Composite Materials and structure*, IIT Kharagpur, India.

B. Tech. AE VI SEMESTER

FLIGHT VEHICLE DESIGN AND SIMULATION LAB

Course Code: **A1721**

L	T	P	C
-	-	3	2

FLIGHT VEHICLE DESIGN LAB

1. Objectives Requirements of the vehicle
2. Conceptual Sketch and first estimate of weight
4. Initial Sizing
5. Fuselage and control surfaces
6. Configuration layout.
7. Performance and stability Estimate
8. Load estimates

SIMULATION LAB

1. Falling sphere with viscous drag – Investigate velocity versus time plot and simulate the fall.
2. Frequency response for a spring-mass system; simulation of the oscillations.
3. Digital simulation of Analog Computations.
4. Simulate a bomb drop from an aircraft on a moving tank for pure –pursuit motion.
5. Simulate an Air Speed Indicator to read air speeds for the pressures read from a Pitot-static tube, with compressibility corrections.
6. Simulate a runaway.
7. Simulate a point take-off from a runaway.

B. Tech. AE VI SEMESTER

AERODYNAMICS AND PROPULSION LAB

Course Code: **A1722**

L	T	P	C
-	-	3	2

AERODYNAMICS LAB

1. Fluid flow studies using blower
2. Calibration of low speed wind tunnel
3. Drag of different bodies
4. Pressure distribution studies on two-dimensional models
5. Pressure distribution over an airfoil at different angles of attack
6. Aero dynamic Characterization on NACA - 0012 Air Foil
7. Axial Flow Compressor
8. Centrifugal Flow Compressor
9. Flow Visualization Techniques.

PROPULSION LAB

1. Study of piston engine (Valve Timing and Port Timing Diagram)
2. Stripping of a piston engine, visual inspection and reasoning for common troubles and trouble shooting
3. Performance of piston engine
4. Heat Balance Test on piston engine
5. Engine Balancing
6. Characterization of Aviation fuels

EQUIPMENT NEEDED

1. Low Speed Wind-tunnel Test Rig with a test section of 1 meter X 1 meter with necessary accessories.
2. Test Rig for Axial flow Compressor
3. Test rig for centrifugal flow compressor.
4. Heat Engine Test Rig.
5. Balancing test Rig
6. Calorimeter apparatus
7. Piston Engine

SYLLABI FOR VII SEMESTER

B. Tech. AE VII SEMESTER

HEAT TRANSFER

Course Code: **A1326**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION: Modes and mechanisms of heat transfer, Basic laws of heat transfer, Applications of heat transfer. General three dimensional heat conduction equations in Cartesian, Cylindrical and Spherical coordinates. Different forms of general equation, Steady state and Transient heat transfer, Initial and boundary conditions.

UNIT - II

CONDUCTION HEAT TRANSFER: One dimensional steady state heat conduction through Homogeneous slabs, hollow cylinders and spheres, Overall heat transfer coefficient, Electrical analogy, Critical radius of insulation. Systems with variable thermal conductivity and Systems with internal heat generation. Extended surfaces (Fins), Long, Short and insulated tips.

ONE DIMENSIONAL TRANSIENT HEAT CONDUCTION: Systems with negligible internal resistance, Significance of Biot and Fourier Numbers, Chart solutions of transient conduction systems.

UNIT - III

CONVECTIVE HEAT TRANSFER: Concepts of Continuity, Momentum and Energy Equations. Dimensional analysis-Buckingham's Pi Theorem - Application for developing non-dimensional correlation for convective heat transfer.

FORCED CONVECTION: External Flows**,** Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for Flat plates and Cylinders. Internal Flows**,** Concepts about Hydrodynamic and Thermal Entry Lengths, use of empirical correlations for Horizontal Pipe Flow and annulus flow.

FREE CONVECTION: Development of Hydrodynamic and thermal boundary layer along a vertical plate , Use of empirical relations for Vertical plates and pipes.

UNIT - IV

BOILING AND CONDENSATION: Regimes of Pool boiling and Flow boiling, Critical heat flux, Calculations on Nucleate Boiling. Film wise and drop wise condensation, Nusselt's theory of condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

HEAT EXCHANGERS: Classification of heat exchangers, overall heat transfer Coefficient and fouling factor, Concepts of LMTD and NTU methods, Problems using LMTD and NTU methods.

UNIT - V

RADIATION HEAT TRANSFER: Emission characteristics , Laws of black-body radiation, Irradiation ,Total and monochromatic quantities , Laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann , Heat exchange between two black bodies , concepts of shape factor , Emissivity ,heat exchange between grey bodies , radiation shields ,electrical analogy for radiation networks.

TEXT BOOKS:

1. Yunus A. Cengel (2012), *Heat Transfer a Practical Approach*, 4th edition, Tata McGraw hill education (P) Ltd, New Delhi, India.
2. R. C. Sachdeva (2012), *Fundamentals of Engineering, Heat and Man Transfer*, 3rd edition, New Age, New Delhi, India.

REFERENCE BOOKS:

1. Holman (2012), *Heat Transfer (SI Units)*, 10th edition, Tata McGraw hill education (P) Ltd, New Delhi, India.
2. P. S. Ghoshdastidar (2012), *Heat Transfer*, 2nd edition, Oxford University Press, New Delhi, India.
3. Incropera, Dewitt (2012), *Fundamentals of Heat Transfer*, 6th edition, John Wiley, UK.

B. Tech. AE VII SEMESTER

COMPUTATIONAL FLUID DYNAMICS

Course Code: **A1723**

L	T	P	C
4	-	-	4

UNIT - I

BASICS: Introduction to computational fluid dynamics, Research tool, Design Tool, Finite control volume, infinitesimal fluid element, substantial derivatives, divergence of Velocity.

GOVERNING EQUATIONS OF FLUID DYNAMICS: The continuity equation, the momentum equation, the energy equation, physical boundary conditions.

UNIT - II

SHOCK FITTING AND SHOCK CAPTURING: Form of Governing equation suited for CFD. Conservation form, shock fitting and shock capturing.

IMPACT OF PARTIAL DIFFERENTIAL EQAUTIONS ON CFD: Introduction, Classification of Quasi-Linear Partial differential equation, The Eigen value method, General behavior of different classes of Partial differential equation, elliptic, parabolic and hyperbolic.

UNIT - III

DISCRETIZATION: Introduction, Finite differences, difference equations, Explicit and implicit approaches, Errors and an analysis of stability.

TRANSFORMATIONS: Introduction, transformation of the governing partial differential equations, Matrices and the Jacobian of transformation.

UNIT - IV

GRID GENERATIONS - I: Grid Generation techniques, Elliptic Grid Generator, Simply connected domain, doubly connected domain.

UNIT - V

GRID GENERATIONS - II: Coordinate system control, Grid Point clustering, Introduction to Hyperbolic Grid Generation techniques and parabolic grid generator.

TEXT BOOKS:

1. T. J. Chung (2010), *Computational Fluid Dynamics*, 2nd edition, Cambridge University Press, Cambridge, UK.
2. John D. Anderson (2010), *Computational Fluid Dynamics*, McGraw Hill, New Delhi.
3. John C. Tannehill, Richard H. Pletcher (1997), *Computational Fluid Mechanics and Heat transfer*, 2nd edition, Taylor & Francis Group, New York.

REFERENCE BOOKS:

1. Ronnie Anderson (2012), *Computational Fluid Dynamics for Engineers*, Cambridge University Press, Cambridge, UK.
2. Jean-Jacques Chattot (2010), *Computational aerodynamics and fluid dynamics an introduction*, Springer, Germany.

B. Tech. AE VII SEMESTER

VIBRATIONS AND STRUCTURAL DYNAMICS

Course Code: **A1724**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION: Simple harmonic motion, terminology, Newton's Law, D'Alembert's Prinicple, Resonance, Introduction to mechanism of damping. Damped and Undamped oscillations. Degrees of freedom. Various mechanisms of damping. Equivalent viscous damping.

SINGLE DEGREE OF FREEDOM SYSTEMS: Free vibrations, free damped vibrations, forced vibrations with and without damping. Support excitation and vibration measuring instruments. Amplitude and Phase response diagrams. Generalized single degree of freedom systems for continuous structures and computation of K, M and C.

UNIT - II

MULTI DEGREE OF FREEDOM SYSTEMS: Two / Three degree of freedom systems, static and dynamic coupling, vibration absorbers, Principal coordinates, Principal modes, Othogonality conditions Hamilton's Principle, Lagrange's equation and application. Longitudinal vibration, lateral vibration, torsional vibration of shafts, dynamical equations of equilibrium of elastic bodies, natural frequencies and modeshapes determination.

UNIT - III

METHODS: determining natural frequencies and mode shape. Natural Vibrations of solid continua. Determination of Eigen Values and Eigen modes.

SHAFTS: Natural frequency of rotating shafts Whirling of shafts. Dynamic balancing of rotating shafts. Dynamic dampers.

UNIT - IV

APPROXIMATE METHODS FOR FREQUENCY: Introduction to approximate methods for frequency analysis Rayleigh Ritz method for vibration analysis. Diagonalization of stiffness, mass and damping matrices using orthogonality conditions.

UNIT - V

MATRICES FOR DYNAMIC ANALYSIS: Introduction to Matrices for dynamic analysis, Kinematically consistent Load systems and determination of [K], [M], [C] and [L] matrices. Normalization and formulation of modal equations. Steady state response, using fourier analysis for decomposing complex periodie load functions, of modal equations using S-plane representation. Transient response analysis of modal equations using Duhamel's integrals.

TEXT BOOKS:

1. R. W. Clough and Penzien (2010), *Dynamics of Structures*, 2nd edition, McGraw Hill, New Delhi.
2. S. S. Rao (2011), *Mechanical Vibrations*, 5th edition, Prentice Hall of India, New Delhi.
3. J. S. Rao, Gupta K. (2002), *Theory and practice of Mechanical vibrations*, Wiley Eastern Ltd, USA.

REFERENCE BOOKS:

1. Fug Y. C. (2008), *An Introduction to Theory of Aeroelasticity*, Dover Publications, US
2. Timoshenko S (2011), *Vibration Problems in Engineering*, 2nd edition, Oxford city press, USA.
3. Cyril M. Harris (2010), *Harris' shock and vibration handbook,* 6th edition, McGraw- Hill, New Delhi.

B. Tech. AE VII SEMESTER

AVIONICS
(Common to AE & ECE)

Course Code: **A1725**

L	T	P	C
4	-	-	4

UNIT - I

BASICS: Basic principles of Avionics, Typical avionics sub system in civil/ military aircraft and space vehicles.

FLIGHT DECK AND DISPLAY SYSTEMS: Flight deck display technologies, CRT, LED, LCD, Touch screen, Head up display, Electronic instrumentation systems.

UNIT - II

AUDIO AND COMMUNICATION SYSTEMS: Aircraft audio systems, basic audio transmitter and receiver principles, VHF communication system, UHF communication systems.

UNIT - III

RANGING AND LANDING SYSTEMS: VHF Omnirange, VOR receiver principles, distance maturity equipment, principles of operation, Instrument landing system, localizer and glideslope.

POSITIONG SYSTEM: Global positioning system principles, triangulation, position accuracy, applications in aviation.

UNIT - IV

INERTIAL NAVIGATION SYSTEM: Principle of Operation of INS, navigation over earth, components of inertial Navigation systems, accelerometers, gyros and stabilized platform.

SURVELLIENCE SYSTEM: ATC surveillance systems principles and operation interrogation and replay standards, Collision avoidance system, ground proximity warning system.

UNIT - V

AUTO FLIGHT SYSTEM: Automatic flight control systems fly by wire and fly by light technologies, flight director systems, flight management systems. Integrated Data transfer methodology by use of MILS - STD - 1553/ ARINC - 429.

TEXT BOOKS:

1. N. S. Nagaraja(1996), *Elements of electronic navigation*, 2nd edition, Tata McGraw Hill, New Delhi.
2. Janes W. Wasson, Jeppesen Sandersen(1994), *Avionic systems Operation and maintenance*, Sterling Book House, Mumbai.

REFERENCE BOOKS:

1. Albert Hel Frick (2010), *Principle of Avionics*, 6th edition, Avionics Communications Inc, India.
2. E. H. J. Pallet (2010), *Aircraft Instrumentation and Integrated systems*, Pearson Education, New Delhi.
3. J. Powell (1998), *Aircraft Radio Systems*, Pitman publishers, London.

B. Tech. AE VII SEMESTER

HUMAN VALUES AND ETHICS

Interdepartmental Elective - II

(Common to AE, EEE, ME & CE)

Course Code: **A1016**

L	T	P	C
4	-	-	4

UNIT - I

HUMANVALUES: Morals, values and ethics, integrity, work ethic, service learning, civic virtue, respect for others, living peacefully, caring, sharing, honesty, courage, valuing time, co-operation, commitment, empathy, self-confidence, character and spirituality.

UNIT - II

ENGINEERING ETHICS: Senses of 'Engineering Ethics', variety of moral issued, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, consensus and controversy, models of professional roles, theories about right action, self-interest, customs and religion, uses of ethical theories.

UNIT - III

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as experimentation, engineers as responsible experimenters, codes of ethics, a balanced outlook on law, the challenger case study.

UNIT - IV

SAFETY, RESPONSIBILITIES AND RIGHTS: Safety and risk, assessment of safety and risk, risk benefit analysis and reducing risk, the Three Mile Island and Chernobyl case studies. Collegiality and loyalty, respect for authority, collective bargaining, confidentiality, conflicts of interest, occupational crime, professional rights, employee rights, Intellectual Property Rights (IPR), discrimination.

UNIT - V

GLOBAL ISSUES: Multinational corporations, environmental ethics, computer ethics, weapons development, engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of ethics like ASME, ASCE, IEEE, institution of engineers (India), Indian institute of materials management, institution of electronics and telecommunication engineers (IETE),India, etc.

TEXT BOOKS:

1. Mike Martin, Roland Schinzinger(1996), *Ethics in Engineering*, McGraw-Hill, New York.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S (2004), *Engineering Ethics*, Prentice Hall of India, New Delhi, India.

REFERENCE BOOKS:

1. Charles D. Fleddermann(2004), *Engineering Ethics*, Pearson Education / Prentice Hall, New Jersey.
2. Charles E Harris, Michael S. Protchard, Michael J Rabins(2000), *Engineering Ethics - Concepts and Cases*, Wadsworth Thompson Learning, United States.
3. John R Boatright(2003), *Ethics and the Conduct of Business*, Pearson Education, New Delhi.
4. Edmund G Seebauer and Robert L Barry, (2001), *Fundamentals of Ethics for Scientists and Engineers,* Oxford University Press, New York.

B. Tech. AE VII SEMESTER

HUMAN RESOURCE MANAGEMENT

Interdepartmental Elective - II

(Common to AE, EEE, ME & CE)

Course Code: **A1017**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION HUMAN RESOURCE MANAGEMENT: Introduction and significance of HRM, Scope, functions of HRM, changing environment of HRM and Challenges. Human Resource Planning, Objectives, Factors influencing Human Resource planning, HR Planning Process.

UNIT - II

JOB ANALYSIS AND RECRUITMENT: Process and Sources of Recruitment; Selection, process of selection and techniques, Retention of Employees.

UNIT - III

HUMAN RESOURCES DEVELOPMENT: Training Vs Development, Need, Process of training, Methods of training, Training Evaluation, Career planning, Performance Management System, Methods of Appraisal, Common Errors.

UNIT - IV

COMPENSATION MANAGEMENT: Concepts and components of wages, Factors influencing wage fixation, Job evaluation, Methods of payment, Incentives and Fringe benefits.

UNIT - V

MANAGING INDUSTRIAL RELATIONS: Components of Industrial Relation, Trade Unions, functions of Trade Union, Employee Participation, Importance and Schemes, Collective Bargaining, Grievance Redressal, Industrial Dispute Settlement machinery.

TEXT BOOKS:

1. Biswajeet Pattnayak (2009), *Human Resource Management*, Prentice hall of India, New Delhi, India.
2. R. Wayne Mondy and Robert M. Noe (2009), *Human Resource Management*, Pearson, India.

REFERENCE BOOKS:

1. Aswathappa. K. (2007), *Human Resources and Personnel Management*, Tata MC Graw Hill, New Delhi, India.
2. Monappa. A, Saiyadain. M. (1979), *Personnel Management*, Tata Mc Graw Hill, New Delhi, India.
3. C. B. Mamoria (2003), *Personnel Management*, Himalaya Publishing House, India.

B. Tech. AE VII SEMESTER

ENTERPRENEURSHIP

Interdepartmental Elective - II

(Common to AE, EEE, ME & CE)

Course Code: **A1018**

L	T	P	C
4	-	-	4

UNIT - I

ENTREPRENEURSHIP: Importance and role of entrepreneurship, Characteristics of entrepreneurship, Qualities of an entrepreneur, Functions of entrepreneur; Theories of entrepreneurship, Stimulants of entrepreneurship and Barriers to entrepreneurship, Ethics and Social Responsibility, Role of entrepreneur in economic development.

UNIT - II

INSTITUTIONAL SUPPORT: Role of Government; Role of IDBI, SIDBI, SIDO, NIESBUD, SISI, DIC, Entrepreneurship Development Institute, MSMEs.

UNIT - III

WOMEN ENTREPRENEURSHIP: Role & Importance, Functions of women entrepreneur, Profile of Indian Women Entrepreneur, Problems of Women Entrepreneurs, Women Entrepreneurship Development in India and in Foreign Countries.

UNIT - IV

PROJECT MANAGEMENT: Concept of project and classification of project identification, project formulation - project report - project design, Project appraisal - profitability appraisal - project planning - social cost benefit analysis - financial analysis and project financing.

UNIT - V

TRAINING: Designing appropriate training programmes to inculcate Entrepreneurial Spirit, significance of entrepreneurial training, Training for New and Existing Entrepreneurs, Feedback and Performance of Trainees.

TEXT BOOKS:

1. Robert Hisrich, Michael P. Peter, Dean A. Shepherd (2010), E*ntrepreneurship*, Tata Mc Graw Hill, New Delhi.

REFERENCE BOOKS:

1. Bholanath Datta (2009), *Entrepreneurship*, Excel publications, India.
2. David H Holt (2010), *Entrepreneurship*, Prentice hall of India, New Delhi, India.

B. Tech. AE VII SEMESTER

BUSINESS COMMUNICATION

Interdepartmental Elective - II

(Common to AE, EEE, ME & CE)

Course Code: **A1019**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION TO MANAGERIAL COMMUNICATION: Meaning, Importance and objectives, Principles of Communication, Forms of communication, Communication Process, Barriers To effective communication, Gateways to effective communication.

UNIT - II

NONVERBAL COMMUNICATION: Body Language, Gestures, Postures, Facial Expressions, Dress Code. Listening and Speaking Skills, Probing questions, Observation, Business and Social etiquette.

UNIT - III

MANAGERIAL SPEECHES: Principles of Effective Speech & Presentations. Technical and Non-technical presentations. Speech of introduction, speech of thanks, occasional speech, theme speech, Use of audio visual aids.

UNIT - IV

INTERVIEW TECHNIQUES: Mastering the art of conducting and giving interviews, Placement interviews, discipline/technical interviews, appraisal interviews, exit Interviews. *Group communication*: Importance, Meetings, group discussions, Video conferencing.

UNIT - V

INTRODUCTION TO BUSINESS CORRESPONDENCE: *Business letters*: Enquiries, Circulars, Quotations, Orders, Acknowledgments, Executions, Complaints, Persuading letters, Sales letters, Job application letters, Bio-data, Covering Letter, Interview Letters, Letter of Reference, Memos, minutes, Circulars and Notices. *Reports:* Types of Business Reports - Format, Choice of vocabulary, Coherence, paragraph writing, organization reports by individual, Report by committee.

TEXT BOOKS:

1. Lesikar R. V, Flatley M. E (2005), *For Empowering the Internet Generation*, Tata McGraw Hill Publishing Company Ltd., New Delhi, India.
2. Ludlow. R, Panton. F (1998), *The Essence of Effective Communications*, Prentice Hall of India Pvt. Ltd., New Delhi, India.

REFERENCE BOOKS:

1. Adair .J (2003), *Effective Communication,* Pan Macmillan, London.
2. Pan Mcmillan Thill J. V, Bovee G. L (1993), *Excellence in Business Communication,* Tata McGraw Hill, New York.
3. Bowman J.P, Branchaw P. P (1987), *Business Communications: From Process to Product*, Dryden Press, Chicago.

B. Tech. AE VII SEMESTER

INTELLECTUAL PROPERTY AND PATENT RIGHTS

(Interdepartmental Elective - II)

Common to AE, EEE, ME & CE

Course Code: **A1020**

L	T	P	C
4	-	-	4

UNIT - I

INTRODUCTION TO INTELLECTUAL PROPERTY: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II

TRADE MARKS: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark' trade mark registration processes.

UNIT - III

LAW OF COPY RIGHTS : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right regisffation, notice of copy right' international copy right law.

LAW OF PATENTS: Foundation of patent law, patent searching process' ownership rights and transfer.

UNIT - IV

TRADE SECRETS: Trade secrete law, determination of trade secrete status' liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

UNFAIR COMPETITION: Misappropriation right of publicity, false advertising.

UNIT - V

NEW DEVELOPMENT OF INTELLECTUAL PROPERTY: New developments in trade mark law; copy right law patent law, intellectual property audits'. International overview on intellectual property, international - trade mark law, copy right law, international patent law, and international development trade secrets law.

TEXT BOOKS:

1. Deborah. E. Bouchoux (2009*), Intellectual property*, Cengage learning, India.
2. Deborah. E. Bouchoux (2001), *Protecting your companies intellectual property*, AMACOM, USA.

REFERENCE BOOKS:

1. Prabudda ganguli (2003), *Intellectual property right*, Tata McGraw Hill Publishing company ltd., India.
2. Robert Hisrich, Michael P. Peter, Dean A. Shepherd (2010), *Entrepreneurship*, Tata Mc Graw Hill, India.

B. Tech. AE VII SEMESTER

PROJECT PLANNING AND MANAGEMENT

Interdepartmental Elective - II

(Common to AE, EEE, ME & CE)

Course Code: **A1021**

L	T	P	C
4	-	-	4

UNIT - I

PERT AND CPM : Introduction, origin of PERT and CPM, planning, scheduling and controlling, bar charts, milestone charts, weaknesses in bar charts, PERT and CPM networks comparison, event, activity, rules for drawing networks, numbering the events (Fulkerson's law), dummy activities.

UNIT - II

CPM - PERT NETWORK ANALYSIS : Time estimate, expected time, earliest allowable occurrence time, latest allowable occurrence time, slack, project duration, probability of completion, start and finish time estimates, floats, project scheduling, critical and sub-critical path. Updating - process of updating, when to update.

UNIT - III

CPM COST MODEL AND RESOURCES ALLOCATIONS, RESOURCE SCHEDULING : Cost analysis, direct and indirect costs, operation time, normal and crash times and costs, optimizing project cost, crash limit, free float limit, optimization. Resource smoothening, resource leveling.

UNIT - IV

MANAGEMENT: Scope of construction management, significance of construction management, concept of scientific management, psychology in management, a historical account of management philosophy, qualities of manager, the roles/functions performed by effective and competent managers, the manager - as a decision maker, as a motivator, as a communication-link, as a conflict resolver, as a well wisher of co-employees and the employer etc.

UNIT - V

ORGANIZATION: Types of organization, merits and demerits of different types of organization, authority, policy, recruitment process and training; development of personnel department; labor problems; labor legislation in India; 'workmen's compensation act of 1923 and minimum wages act of 1948', and subsequent amendments. Safety in construction.

TEXT BOOKS:

1. Punmia, Khandelwal (2006), *Project planning and control with PERT and CPM*, 3rd edition, Laxmi Publications, New Delhi, India.

REFERENCE BOOKS:

1. L. S. Srinath (1975), *PERT and CPM*, 2nd Edition, Afflicted East West Press Pvt. Ltd, New Delhi, India.
2. U. K. Shrivastava (1999), Construction Planning and Management, Galgotia Publications Pvt. Ltd., New Delhi.

B. Tech. AE VII SEMESTER

SPACE MECHANICS
(Professional Elective - I)

Course Code: **A1726**

L	T	P	C
3	1	-	4

UNIT - I

BASIC CONCEPTS: The solar system, Reference frames and coordinate systems, The celestial sphere, The ecliptic, Motion of vernal equinox, Sidereal time, Solar Time, Standard Time, The earth's atmosphere

THE GENERAL N-BODY PROBLEM: The many body problem, Lagrange-Jacobi identity. The circular restricted three-body problem, Libration points, Relative Motion in the N-body problem

UNIT - II

THE TWO-BODY PROBLEM: Equations of motion-General characteristics of motion for different orbits-Relations between position and time for different orbits, Expansions in elliptic motion, Orbital Elements. Relation between orbital elements and position and velocity.

THE LAUNCHING OF A SATELLITE: Launch vehicle ascent trajectories, General aspects of satellite injection. Dependence of orbital parameters on in-plane injection parameters, Launch vehicle performances, Orbit deviations due to injection errors

UNIT - III

PERTURBED SATELLITE ORBITS: Special and general perturbations- Cowell's Method, Encke's method. Method of variations of orbital elements, General perturbations approach

INTERPLANETARY TRAJECTORIES: Two-dimensional interplanetary trajectories, Fast interplanetary trajectories, Three dimensional interplanetary trajectories. Launch of interplanetary spacecraft. Trajectory about the target planet

UNIT - IV

BALLISTIC MISSILE TRAJECTORIES: The boost phase, the ballistic phase, Trajectory geometry, optimal flights. Time of flight, Re-entry phase. The position of the impact point, Influence coefficients.

UNIT - V

LOW-THRUST TRAJECTORIES: Equations of Motion. Constant radial thrust acceleration, Constant tangential thrust (Characteristics of the motion>), Linearization of the equations of motion, Performance analysis.

TEXT BOOKS:

1. J. W. Cornelisse (1979), *Rocket Propulsion and Spaceflight Dynamics*, Pitman Publishing, London.
2. William E. Wiesel (2010), *Spaceflight Dynamics*, 3rd edition, McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Charles D. Brown (1998), *Spacecraft Mission Design*, 2nd Edition, AIAA Education Series, USA.
2. Vladimir A. Chobotov (2002), *Orbital Mechanics*, 3rd Edition, AIAA Education Series, USA.
3. David A. Vellado (2007), *Fundamentals of Astrodynamics and Applications*, 3rd Edition, Springer, Germany.

B. Tech. AE VII SEMESTER

AERO ELASTICITY
(Professional Elective - I)

Course Code: **A1727**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION: Introduction to Aero elasticity COLLARS Triangle, Aerodynamics and interactions of Structural and Inertial forces Static and Dynamic Aero Elasticity Phenomena. Simple Two dimensional idealization of flow, String Theory, Fredholm Integral equations of Second Kind Exact Solutions for simple rectangular wings.

UNIT - II

ANLYTICAL METHODS: Formulations of Structural Dynamics Equation and Coupling effects for panels and plates, generalized coordinates, Lagrange's Equations of motion Hamilton's Principle Orthogonality conditions. Static Aero elastic Studies Divergences, control reversal, Aileron reversal speed, Aileron efficiency, lift distribution, Rigid and elastic wings.

UNIT - III

EXPERIMENTAL ANALYSIS: Non-dimensional Parameters, stiffness criteria, dynamic mass balancing, model experiments and dimensional similarity, flutter analysis.

EQUATIONS OF AERO ELASTIC: Formulation of Aero elastic Equations for a Typical Section, Quasi Steady Aerodynamic derivatives, modal equations Galerkins method of analysis.

UNIT - IV

FLUTTER: Stability of motion of Continua Torsion flexure flutter, Solution of flutter determinant, method of determining the classical flutter speed, Flutter Prevention and control.

UNIT - V

AERO ELASTICITY APPLICATIONS: Application of Aero Elasticity in Engineering Problems, Galloping of transmission lines, flow induces vibrations of tall slender structures and suspension Budges.

TEXT BOOKS:

1. Dewey H. Hodges, G. Alvin Pierce (2011), *Introduction to Structural Dynamics and Aero Elasticity*, 2nd edition, Cambridge University Press, UK.
2. Fung Y. C. (2008), *An introduction to the Theory of Aero Elasticity*, Dover Publications, USA.
3. Jan R. Wright (2008), *Introduction to Aircraft Aero Elasticity and Loads*, John Wiley, USA.

REFERENCE BOOKS:

1. Raymond L. Bisplinghoff, Holt Ashely (2002), *Principles of Aeroelasticity*, Drovers Publications, USA.
2. Adamu Yebi (2010), *Vibration Analysis of Cracked Composite Aircraft Wing Modeled as Shell*, VMD Verlag, New Delhi.
3. E. H. Dwell (1995), *A Modern Course in Aero elasticity*, Springer Publishers, Germany.

B. Tech. AE VII Semester

FATIGUE AND FRACTURE MECHANICS

(Professional Elective - I)

Course Code: **A1728**

L	T	P	C
3	1	-	4

UNIT - I

FATIGUE OF STRUCTURES: S-N Curves, Endurance limit, Effect of mean stress, Notches and stress concentrations, Neuber's stress concentration factors, Plastic stress concentration factor, Notched S-N curves.

DESIGN OF COMPONENTS: Goodman, Gerber and Soderberg relations and diagrams, Modified Goodman Diagram, Design of components subjected to axial, bending, torsion loads and combination of them.

UNIT - II

STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR: Low cycle and high cycle fatigue, Coffin Manson's relation, Transition life, cyclic strain hardening and softening.

LOAD ASPECTS: Analysis of load histories, Cycle counting techniques, Cumulative damage, Miner's theory, other theories.

UNIT - III

PHYSICAL ASPECTS OF FATIGUE: Phase in fatigue life, Crack initiation, Crack growth, Final fracture, Dislocations, Fatigue fracture surfaces.

FRACTURE MECHANICS: Strength of cracked bodies, Potential energy and surface energy, Griffith's theory, Irwin-Orwin extension of Griffith's theory to ductile materials.

UNIT - IV

STRESS ANALYSIS: Stress analysis of cracked bodies, Effect of thickness on fracture toughness, Stress intensity factors for typical geometries. Introduction of finite element approach for crack propagation studies.

UNIT - V

FATIGUE DESIGN AND TESTING: Safe life and fail-safe design philosophies, Importance of fracture mechanics in aerospace structure, Application to composite materials structures.

TEXT BOOKS:

1. J. F. Knott (1983), *Fundamentals of Fracture Mechanics*, Butter Worth & Co., Publishers Ltd., London.
2. C. G. Sih (1989) *Mechanics of Fracture*, Vol. I, Sijthoff and Noordhoff International Publishing Co., Netherlands.

REFERENCE BOOKS:

1. W. Barrois, E. L. Ripley (1983), *Fatigue of Aircraft Structures*, Pergamum Pres., Oxford, USA.

B. Tech. AE VII SEMESTER

NANO TECHNOLOGY

(Professional Elective - I)

Course Code: **A1344**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION TO NANOTECHNOLOGY: Importance of nano scale, Nanostructure types, electronic, magnetic, optical Properties of Nano materials, top-down and bottom- up approach to nanostructures.

QUANTUM MECHANICAL PHENOMENON IN NANOSTRUCTURES: Quantum confinement of electrons in semiconductor Nano structures, one dimensional confinement (Quantum wires), two dimensional confinements (Quantum Wells), three dimensional confinements (Quantum dots).

UNIT - II

CARBON NANO STRUCTURES: Carbon nano tubes (CNTs), Fullerenes, C60, C80 and C240 Nanostructures, Properties (mechanical, optical and electrical) and applications.

UNIT - III

FABRICATION OF NANO MATERIALS: Physical Methods: Inert gas condensation, Arc discharge, RF plasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Molecular beam epitaxy, Chemical vapour deposition method.

NANO SCALE CHARACTERIZATION TECHNIQUES: Scanning probe techniques (AFM, STM, SEM, TEM), XRD

UNIT - IV

NANO DEVICES AND NANO MEDICINE: Lab on chip for bio-analysis, Core/shell Nano particles in drug delivery systems (site specific and targeted drug delivery), cancer treatment, and bone tissue treatment.

UNIT - V

NANO AND MOLECULAR ELECTRONICS: Resonant-Tunneling structures, single electron tunneling, Single Electron transistors, coulomb blockade, giant magneto resistance, tunneling magneto resistance.

NANOLITHOGRAPHY AND NANO MANIPULATION: E-beam lithography and SEM based nanolithography and nano manipulation, Ion beam lithography, oxidation and metallization, Mask and its application, Deep UV lithography, X-ray based lithography.

TEXT BOOKS:

1. Charles. P. Pode (2010), *Introduction to nanotechnology*, Reprint Edition, Springer, Germany.
2. Bharat Bhusan (2010), *Springer Handbook of Nanotechnology,* 3rd edition, Springer, Germany.

REFERENCES BOOKS:

1. Phani kumar (2012), *Principles of nanotechnology*, 3rd edition, Scitech publications, India.
2. Challa S, S. Kumar (2007), *Nanofabrication towards biomedical application: Techniques, tools, Application and Impact,* 1st edition, Wiley, VCH USA.
3. Hari Singh Nalwa (2011), *Encyclopedia of Nanotechnology*, American Scientific Publishers, USA.
4. S. Dutta (2009), *Electron Transport in Mesoscopic systems*, 8th Print, Cambridge University press, UK.

B. Tech. AE VII SEMESTER

BOUNDARY LAYER THEORY

(Professional Elective - I)

Course Code: **A1729**

L	T	P	C
3	1	-	4

UNIT - I

BASIC LAWS: Basic laws of fluid flow: Continuity, momentum and energy equations as applied to system and control volume, Concept of flow fields.

FUNDAMENTALS OF BOUNDARY LAYER THEORY: Viscous fluid flow, Boundary conditions. Development of boundary layer, Estimation of boundary layer thickness. Displacement thickness, momentum and energy thickness for two-dimensional flows. General stress system in a deformable body, General strain system.

UNIT - II

LAMINAR BOUNDARY LAYER: Analysis of flow past a flat plate and a cylinder, Integral relation of Karman, Integral analysis of energy equation, laminar boundary layer equations, Flow separation, Blasius solution for flat–plate flow, Boundary layer temperature profiles for constant plate temperature.

UNIT - III

NAVIER STOKES EQUATION: Relation between stress and strain system in a solid body (Hooke's Law). Relation between stress and strain rate system in liquids and gases (Stroke's Law). The Navier - Strokes Equation (N-S), General properties of Navier - Stokes Equation.

EXACT SOLUTION OF N-S EQUATION: Two dimensional flow through a straight channel, Hagen - Poiseulle flow, suddenly accelerated plane wall, Flow near a rotating disk, Very slow motion: Parallel flow past a sphere.

UNIT - IV

BOUNDARY LAYER METHODS: Falkner Skan Wedge flows, Integral equation of Boundary layer - Pohlhausen method, Thermal boundary calculations: One parameter and two parameter integral methods.

UNIT - V

INCOMPRESSIBLE TURBULENT MEAN FLOW: Two-dimensional turbulent boundary layer equations, Integral relations, Eddy viscosity theories, Velocity profiles.

COMPRESSIBLE - BOUNDARY LAYER FLOW: The law of the wall, the law of the wake, Turbulent flow in pipes and channels, Turbulent boundary on a flat plate, Boundary layers with pressure gradient.

TEXT BOOKS:

1. S. B. Pope (2010), *Turbulent flows*, Reprinted Edition, Cambridge University Press, USA.
2. Hermann Schlichting (2004), *Boundary Layer Theory*, 8th edition, Springer, Germany.
3. Panton R. L (2005), *Incompressible Flow*, 3rd Edition, John Wiley & Sons, USA.

REFERENCE BOOKS:

1. Biman Chandra Chetia (2010), *Fuzzy Modeling of the Boundary-Layer Theory*, Vdm Verlag, New York
2. White F. M (2007), *Viscous fluid Flow*, 3rd edition, McGraw Hill, New Delhi

B. Tech. AE VII SEMESTER

EXPERIMENTAL STRESS ANALYSIS

(Professional Elective - I)

Course Code: **A1730**

L	T	P	C
3	1	-	4

UNIT - I

MEASUREMENTS: Basic principles, Accuracy, Sensitivity, Range Measurements, Errors.

EXTENSOMETERS: Mechanical, Optical, Acoustical and Electrical extensometers and their use, Advantage and disadvantage.

UNIT - II

STRAIN GAUGE - PRINCIPLES: Principles and operation of electrical strain gauge, Requirement, Type and their uses, Material for strain gauge, Calibration, Cross sensitivity, Rosette Analysis.

STRAIN GAUGE - STRAIN MEASUREMENT: Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, Strain indicator.

UNIT - III

PHOTOELASTICITY: Two dimensional Photo elasticity, Concept of Light, Photo, elastic effects, Stress and optic law.

FRINGE INTERPOLATION TECHNIQUS: Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic material.

UNIT - IV

NON-DESTRUCTIVE TESTING - I: Fundamentals of Non Destructive Testing, Radiography, Ultrasonic Inspection, Ultrasonic C-Scan, Magnetic particles Inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique.

UNIT - V

NON-DESTRUCTIVE TESTING - II: Fundamentals of brittle coating methods, Introduction to Moiré Techniques, Holography, Thermography.

TEXT BOOKS:

1. Daily J. W, Riley W. F (2005), *Experimental Stress Analysis*, 4th edition, McGraw- Hill, New Delhi.
2. Thomas G. Beckwith, Maragoni, Lienhard (2009), Mechanical Measurements, 6th edition, Pearson Education, New Delhi.
3. Prasad (2011), *Non- Destructive Test and Evaluation of Materials*, 1st edition, Tata McGraw-Hill, New Delhi.
4. R. Halmshaw (1991), Non-*Destructive Testing*, 2nd edition, Edward Arnold, New York.

REFERENCE BOOKS:

1. Sadhu Singh (2009), *Experimental stress Analysis*, 3rd edition, Khanna Publications, New Delhi.
2. L S Srinath (1984), *Experimental Stress Analysis,* 2nd edition, Tata McGraw-Hill, New Delhi.

B. Tech. AE VII SEMESTER

COMPUTER AIDED AIRCRAFT MODELING AND ASSEMBLY LAB

Course Code: **A1731**

L	T	P	C
-	-	3	2

DESIGN OF THE AIRCRAFT COMPONENTS USING CATIA

1. Design of airfoils and wings
2. Design of fuselage with seating arrangement
3. Design of propeller shaft and blades
4. Design of landing gear
5. Design of horizontal and vertical stabilizer
6. Design of nose cone
7. Design of door of aircraft

ASSEMBLY OF THE AIRCRAFT COMPONENTS USING PRO-E

1. Assemble the wings to fuselage
2. Assemble the seating arrangement in fuselage
3. Assemble the engine along with propeller shaft and blades in fuselage
4. Assemble the landing gears to fuselage
5. Assemble the horizontal and vertical to fuselage
6. Assemble the door to fuselage

B. Tech. AE VII SEMESTER

HEAT TRANSFER AND COMPUTATIONAL FLUID DYNAMICS (CFD) LAB

Course Code: **A1732**

L	T	P	C
-	-	3	2

HEAT TRANSFER LAB

1. Composite slab apparatus overall heat transfer co efficient
2. Heat transfer through lagged pipe
3. Heat transfer through a concentric sphere
4. Thermal conductivity of given metal rod
5. Heat transfer in pin-fin
6. Experiment on transient heat conduction
7. Heat transfer in forced convection apparatus
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger
10. Emissive apparatus

CFD LAB

1. Numerical solutions for any one of the following using Finite Difference method
    a. Elliptic Equations
    b. Parabolic Equations
    c. Hyperbolic Equations
2. Grid generations for any one of the following
    a. Algebraically stretched Cartesian grids
    b. Elliptic Grids
3. Numerical Solutions for any one of the following
    a. Vortex Panel method
    b. Source Panel method
    c. Incompressible Coutte flow
    d. Supersonic flow over a flat plate
    e. Grid generation of aerofoil NACA 0012

EQUIPMENT NEEDED FOR CFD LAB

1. Computers P- IV with 1GB Ram and parallel computational facilities 60 nos / 60 students a batch.
2. 60 educational version licenses of
    a. MAT LAB
    b. Ansys
    c. Nastran
    d. Pro – E
    e. CFX

SYLLABI FOR VIII SEMESTER

B. Tech. AE VIII SEMESTER

AIRCRAFT SYSTEMS AND INSTRUMENTATION

Course Code: **A1734**

L	T	P	C
3	1	-	4

UNIT - I

FLIGHT CONTROL SYSTEMS: Principles of flight control, flight control surfaces, control surface actuation, flight control linkage systems, trim and feel. Power control, mechanical, direct drive, electromechanical, electro-hydrostatic actuation ,multiple redundancy. The fly by wire system. Airbus and Boeing implementations. Inter-relationship of flight control, guidance and vehicle management systems.

UNIT - II

ENGINE CONTROL SYSTEMS: The engine control problem, fuel flow control, air flow control, control system parameters, example systems, design criteria. Engine starting, fuel control, ignition control, engine rotation, throttle levers, engine indications. Engine control on a modern civil aircraft. Integrated flight and propulsion control.

FUEL SYSTEMS: Characteristics of aircraft fuel systems, fuel system components, fuel transfer pumps, fuel booster pumps, fuel transfer valves, non return valves. Fuel quantity measurement systems, level sensors, fuel gauging probes. Fuel system operation, fuel pressurization, engine feed, fuel transfer, use of fuel as heat sink, external fuel tanks, fuel jettison, in-flight refueling. Integrated civil aircraft fuel systems.

UNIT - III

HYDRAULIC SYSTEMS: Importance of hydraulic systems, functions to be performed, the hydraulic circuit, actuation, the hydraulic fluid, hydraulic piping, hydraulic pump, fluid conditioning, the reservoir, emergency power sources. Aircraft applications, examples of B Ae, Airbus, Boeing implementations. The landing gear system for retraction, steering, braking and anti-skid.

ELECTRICAL SYSTEMS: Aircraft electrical system characteristics, power (AC and DC) generation. Power generation control, voltage regulation, parallel operation, supervisory and protection functions. Modern electrical power generation types, constant frequency, variable frequency, variable speed constant frequency types. Primary power distribution, power conversion and energy storage. Secondary power distribution, power switching, load protection. Electrical loads, motors and actuators, lighting, heating, subsystem controllers, ground power. Emergency power generation. Electrical load management system.

UNIT - IV

PNEUMATIC SYSTEMS AND ENVIRONMENTAL CONTROL SYSTEMS: Use of pneumatic power in aircraft. Sources of pneumatic power, the engine bleed air, engine bleed air control. Users of pneumatic power, wing and engine anti-ice, engine start, thrust reversers, hydraulic system, pitot static systems. The need for controlled environment in aircraft. Sources of heat. Environmental control system design, ram air cooling, fuel cooling, engine bleed, bleed flow and temperature control. Refrigeration systems, air cycle and vapour cycle systems, turbo fan, boot strap, reversed boot strap systems. Humidity control. Air distribution systems. Cabin pressurization, g tolerance, rain dispersal, anti-misting and demisting.

AIR CRAFT INSTRUMENTATION: Basics of Aircraft; Aircraft instruments-Types and Cockpit Layout; Air data Instruments; Directional Systems; Gyroscopic and Advanced Flight Instruments; Engine Instruments-Power and Thrust; Engine Fuel Indicators; Electronic Flight Instrument System (EFIS); Aircraft Navigation Systems; Automatic Flight Control System (AFCS); Airborne Radars; Flight Management Systems (FMS); Aircraft Communication Addressing and Reporting System (ACARS/ATN) and Future Air Navigation (FAN); Black Boxes (Cockpit Voice Recorder and Flight data Recorder); Aircraft Safety and warning Systems; Electronic Warfare (EW)

UNIT - V

AIRCRAFT INSTRUMENTATION - SENSORS AND DISPLAYS: Air data sensors, magnetic sensing, inertial sensing, radar sensors. The electromechanical instrumented flight deck, early flight deck instruments, attitude direction indicator, horizontal situation indicator, altimeter, airspeed indicator. Advanced flight deck display system architectures, display systems, display media, future flight deck displays.

SYSTEMS DESIGN AND DEVELOPMENT: System design, specifications and requirement, regulations, guidelines and certification. Safety processes, functional hazard analysis, preliminary systems safety analysis, system safety analysis, common cause analysis. Requirements capture, top-down approach and bottoms-up approach. Fault tree analysis, failure mode and effects analysis, component reliability, dispatch reliability, Markov analysis. Development processes,

software and hardware. Product life cycle phases - concept, definition, design, build, test, operate and disposal or refurbish. Major review processes. Software development process, verification and integration with hardware.

TEXT BOOKS:

1. Allan Seabridge, Ian Moir (2008), *Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration,* 3rd edition, John Willey & Sons, USA.
2. S. Nagabhushana, L. K Sudha (2010), *Aircraft instrumentation and systems,* I. K. International Publishing House, New York.
3. Moir I, Seabridge A (2006), *Civil Avionics Systems*, John Willey & Sons, USA.

REFERENCE BOOKS:

1. E. H. J. Pallett (2010), Aircraft Instruments and Integrated Systems, New Edition, Pearson Education, New Delhi.
2. Harris D (2004), *Flight Instruments and Automatic Flight Control Systems*, 6th edition, Blackwell Science. New York, USA.

B. Tech. AE VIII SEMESTER

ADVANCED COMPUTATIONAL FLUID DYNAMICS

(Professional Elective - II)

Course Code: **A1735**

L	T	P	C
3	1	-	4

UNIT - I

PANEL METHODS: Introduction to panel method, Basic aspects of uniform source and vortex flows, Source panel method, Non-lifting flows over arbitrary two-dimensional bodies.

VORTEX PANEL METHOD: Vortex panel method Lifting flows over arbitrary two-dimensional bodies.

UNIT - II

METHOD OF CHARACTERISTICS: Introduction to numerical techniques for steady supersonic flows, Philosophy of method of characteristics. Determination of characteristic lines, Two-dimensional irrotational flow. Determination of the compatibility equation and unit processes. Regions of influence and Domains of dependence.

APPLICATIONS OF METHOD OF CHARACTERISTICS: Supersonic nozzle design using method of characteristics, Description of Mc Cormack's predictors - Corrector techniques.

UNIT - III

TIME DEPENDENT METHODS - I: Stability of Solution, Explicit time dependent methods: Euler, Backward Euler, One step trapezoidal, Backward differencing, methods, Leap Frog method.

TIME DEPENDENT METHODS - II: Description of Lax-Wendroff Scheme and Mac Cormack's two-step predictor - Corrector method. Description of time split methods and Approximate factorization schemes.

UNIT - IV

BOUNDARY LAYER EQUATION: Introduction to boundary layer equations and their solutions. Description of the boundary layer equations. Transformation of boundary layer equations and the numerical solution method. Choice of discretization model and the generalized Crank- Nicholson Scheme. Discretization of boundary layer equations and illustration of solutions of a tridiagonal system of linear algebraic equations.

UNIT - V

TRANSONIC RELAXATION METHOD: Theoretical aspects of transonic flows, Small Perturbation flows, Transonic small perturbation equations, Central and Backward difference schemes, Shock capturing vs. shock fitting techniques: Conservation vs. non conservation forms of governing equations, Line relaxation techniques.

TEXT BOOKS:

1. T. J. Chung (2010), *Computational Fluid Dynamics*, 2nd edition, Cambridge University Press, USA.
2. John D. Anderson (2010), *Computational Fluid Dynamics*, McGraw Hill, New Delhi.
3. John C. Tannehill, Richard H. Pletcher (1997), *Computational Fluid Mechanics and Heat transfer*, 2nd edition, Taylor & Francis Group, New York.

REFERENCE BOOKS:

1. Ronnie Anderson (2012), *Computational Fluid Dynamics for Engineers*, Cambridge University Press, USA.
2. Jean-Jacques Chattot (2010), *Computational aerodynamics and fluid dynamics an introduction*, Springer, Germany.

B. Tech. AE VIII SEMESTER

INDUSTRIAL AERODYNAMICS
(Professional Elective - II)

Course Code: **A1736**

L	T	P	C
3	1	-	4

UNIT - I

ATMOSPHERE: Types of winds, Causes of variation of wind, Effect of terrain on gradient height.

ATMOSPHERIC BOUNDARY LAYER: Pressure and velocity distribution over the rising car, Wind tunnel model for atmospheric boundary layer, variation of drag force for various positions of the rising car.

UNIT - II

VEHICLE AERODYNAMICS: Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and hovercraft.

UNIT - III

WIND ENERGY COLLECTORS-I: Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

WIND ENERGY COLLECTORS-II: Working principles of horizontal and vertical axis machines, Design of axial machines.

UNIT - IV

BUILDING AERODYNAMICS: Pressure distribution on low-rise buildings, Wind forces on buildings, Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics, Interference effect of Building.

UNIT - V

FLOW INDUCED VIBRATIONS: Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, galloping and stall flutter.

DESIGN OF CHIMNEY: Height of chimney for various gas effluents, Effective height of chimney, flume rise, Different types of flume rise for various climatic conditions.

TEXT BOOKS:

1. Blevins R. D (2001), *Flow Induced Vibrations*, Krieger Publishing Company, USA.
2. Thomas E. Kissell (2011), *Introduction to Wind Power Principles*, Prentice Hall, New York.

REFERENCE BOOKS:

1. Scorer R. S. (1978), *Environmental Aerodynamics*, Halsted Press. New York.
2. Gargeshwari Suryanarayana (2010), *Aerodynamic Drag Reduction of Bluff Bodies*, Lap Lambert Academic Publishing, USA.
3. Sovran M (1978), *Aerodynamics Drag Mechanisms of Bluff Bodies and Road Vehicles*, Plenum Press, New Delhi.
4. Shigehiko Kaneko (2008), *Flow-Induced Vibrations: Classifications and Lessons from Practical Experiences*, Elsevier, USA.

B. Tech. AE VIII SEMESTER

HYPERSONIC AERODYNAMICS
(Professional Elective - II)

Course Code: **A1737**

L	T	P	C
3	1	-	4

UNIT - I

FUNDAMENTALS OF HYPERSONIC FLOWS: Importance/properties of hypersonic flow-Basic equations boundary conditions for inviscid flow, shock wave shapes, flow over a wedge.

HYPERSONIC APPROXIMATIONS: Prandtl-Meyer flow, Axi-symmetric flow over a cone, Flow over a flat plate.

UNIT - II

HYPERSONIC AERODYNAMIC HEATING: Reference temperature method-Entropy layer effects on aerodynamic heating.

UNIT - III

HYPERSONIC SMALL DISTURBANCE THEORY: Flow over a wedge and a cone, Blast wave analogy, Newtonian impact theory, Busemann centrifugal correction, Shock expansion method, Tangent cone and tangent wedge methods.

BASIC ASPECTS OF HYPERSONIC VISCOUS FLOWS: Introduction to viscous flow and pressure interactions over a flat plate, Boundary layers.

UNIT - IV

HYPERSONIC VISCOUS INTERACTIONS: Strong and weak interactions-Shock wave/ boundary layer interactions.

HYPERSONIC VEHICLE DESIGN: Hypersonic propulsion and vehicle design.

UNIT - V

RAREFIED GAS DYNAMICS: Rarefied flow regimes, Kinetic theory of gases-Gas-surface interaction, Aerodynamic forces in hypersonic free molecular flow around simple geometries.

TEXT BOOKS:

1. John David Anderson (2006), *Hypersonic and High Temperature Gas Dynamics*, 2nd edition, AIAA Education Series, USA.
2. John J. Bertin (1994), *Hypersonic Aerothermodynamics*, AIAA Education Series, USA.

REFERENCE BOOKS:

1. Cherni C. G (1961), *Introduction to Hypersonic flow*, Academic Press, New York.
2. Hayes W. D and Probstein R F (1966), *Hypersonic Flow Theory*, 2nd edition, Academic Press, New York.
3. Cox R. N, Crabtree L. P (1965), *Elements of Hypersonic Aerodynamics*, Academic press, New York.

B. Tech. AE VIII SEMESTER

AIRPORT MANAGEMENT
(Professional Elective - II)

Course Code: **A1738**

L	T	P	C
3	1	-	4

UNIT - I

AIRPORTS AND AIRPORT SYSTEMS: Introduction, Airport Management on an international level, Rules that govern airport management, Airport ownership and organization, Airport organization chart, Airport manager and public relations.

THE AIRFIELD: Components of an airport, the airfield, Navigation aids (NAVAIDS) located on airfields, Air traffic Control and surveillance facilities located on the airfield, Weather reporting facilities located on airfields, security infrastructure on airfields.

UNIT - II

AIRSPACE AND AIR TRAFFIC CONTROL: Air traffic control management and operating infrastructure, Basics of air traffic control. Current and future enhancements to air traffic control.

AIRPORT TERMINALS AND GROUND ACCESS: Historical development of airport terminals, Components of airport terminal, Airport ground access.

UNIT - III

AIRPORT OPERATIONS MANAGEMENT: Pavement management-Aircraft rescue and fire fighting (ARFF) Snow and ice control, Safety inspection programs, Bird and wildlife hazard management.

AIRPORT SECURITY: Transportation Security Administration-Security at commercial service airports, Security at general aviation airports.

UNIT - IV

AIRPORT FINACIAL MANAGEMENT: Airport financial accounting-Revenue strategies at commercial airports, Pricing of air port facilities and services, Variation in the sources of operating revenues. Rise in airport financial burdens, Air port funding, Airport financing, Private Investment, Sale of air port.

UNIT - V

AIRPORT CAPACITY AND DELAY: Defining capacity, Factors effecting capacity and delay, Estimating capacity, Simulation Models. Defining delay, Analytical estimates of delay: queuing diagram, Approaches to reducing delay, Administrative and demand management.

TEXT BOOKS:

1. Alexander T. Wells, John G. Wensveen (2008), *Air Transportation: A Management Perspective*, 8th edition, Ashgate Publishing, New Delhi.
2. Alexander T. Wells and Seth B. Young (2011), *Airport Planning and Management*, 6th edition, McGraw-Hill, New Delhi.

REFRENCE BOOKS:

1. Amedeo Odoni, Peter Belobaba and Tom Reynolds(2012), *Airport Systems: Planning, Design and Management,2nd Edition,* McGraw Hill, New Delhi
2. Richard D Neufville (2012), *Airport Systems: Planning, Design and Management,* 2nd edition, McGraw Hill, New Delhi.

B. Tech. AE VIII SEMESTER

NON DESTRUCTIVE TESTING
(Professional Elective - II)

Course Code: **A1739**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION- VISUAL METHODS: Optical aids, In-situ metallographic, Optical holographic methods, Dynamic inspection.

UNIT - II

PENETRANT FLAW DETECTION: Principles, Process, Penetrant systems, Liquid penetrant materials, Emulsifiers, cleaners developers, sensitivity, Advantages, Limitations - Applications.

UNIT - III

RADIOGRAPHIC METHODS: Limitations, Principles of radiography, sources of radiation, Ionizing radiation, X-rays sources, Gama-rays sources Recording of radiation, Radiographic sensitivity, Fluoroscopic methods.

ULTRASONIC TESTING OF MATERIALS: Advantages, disadvantages, Applications, Generation of. Ultrasonic waves, general characteristics of ultrasonic waves. Methods and instruments for ultrasonic materials testing.

LASER TESTING OF MATERIALS: Advantages, disadvantages, Applications, Generation of laser, general characteristics of laser - methods and instruments for laser materials testing.

UNIT - IV

MAGNETIC METHODS: Advantages, Limitations, Methods of generating fields: magnetic particles and suspending liquids Magnetography, field sensitive probes: applications.

ELECTRICAL METHODS: *Eddy current methods*: potential-drop methods, applications.

UNIT - V

ELECTROMAGNETIC TESTING: Magnetism: Magnetic domains: Magnetization curves: Magnetic Hysteresis: Hysteresis-loop tests: comparator - bridge tests Absolute single-coil system: applications.

OTHER METHODS: Acoustic Emission methods, Acoustic methods: Leak detection: Thermal inspection.

TEXT BOOKS:

1. Prasad (2011), *Non- Destructive Test And Evaluation of Materials*, 1st edition, Tata McGraw-Hill, New Delhi.
2. R. Halmshaw (1991), *Non-Destructive Testing*, 2nd Edition, Edward Arnold, USA.

REFERENCE BOOKS:

1. Jack Blitz (1997), *Electrical and Magnetic Methods of Non-Destructive Testing,* Springer, Germany.
2. Jack Blitz (1997), *Ultrasonic Methods of Non-Destructive Testing,* Springer, Germany.
3. Ravi Prakash(2009), *Non-destructive Testing Techniques*, 2nd Edition, New Academic Science Ltd, USA.

B. Tech. AE VIII SEMESTER

THEORY OF PLATES AND SHELLS

(Professional Elective - II)

Course Code: **A1740**

L	T	P	C
3	1	-	4

UNIT - I

CLASSICAL PLATE THEORY: Classical Plate Theory, Assumptions, Differential Equation, Boundary Conditions.

UNIT - II

EIGEN VALUE ANALYSIS: Stability and free Vibration Analysis of Rectangular Plates.

UNIT - III

PLATES OF VARIOUS SHADES: Navier's Method of Solution for Simply Supported Rectangular Plates, Leavy's Method of Solution for Rectangular Plates under Different Boundary Conditions.

GOVERNING EQUATIONS: Solution for Axi-symmetric loading, Annular Plates, Plates of other shapes.

UNIT - IV

APPROXIMATE METHODS: Rayleigh - Ritz, Galerkin Methods, Finite Difference Method. Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.

UNIT - V

SHELLS: Basic Concepts of Shell Type of Structures, Membrane and Bending Theories for Circular Cylindrical Shells.

TEXT BOOKS:

1. S. P. Winowsky, Kreger Timoshenko (1990), *Theory of Plates and Shells*, 2nd edition, McGraw-Hill, New Delhi.
2. Ansel C. Ugural (2009), *Stresses in Beams, Plates and Shells,* 3rd edition, CRC Press, New York.

REFERENCE BOOKS:

1. Flgge W. (1990), *Stresses in Shells*, 2nd edition, Springer, Germany.
2. Timoshenko S. P., Gere J. M. (2009), *Theory of Elastic Stability,* 2nd edition, Dover Publications, USA.

B. Tech. AE VIII SEMESTER

ROCKETS AND MISSILES
(Professional Elective - III)

Course Code: **A1741**

L	T	P	C
3	1	-	4

UNIT - I

SOLID PROPELLANT ROCKET SYSTEMS: Ignition system in rockets, Types of igniters, Igniter design considerations, Combustion system of solid rockets.

LIQUID PROPELLANT ROCKET SYSTEMS: Design consideration of liquid rocket combustion chamber, injector, propellant feed lines, valves, propellant tank outlet and helium pressurized and turbine feed systems, Propellant slosh , Propellant hammer, Geysering effect in cryogenic rocket engines.

UNIT - II

AERODYNAMICS OF ROCKETS AND MISSILES: Airframe components of rockets and missiles, Forces acting on a missile while passing through atmosphere, Classification of missiles. Method of describing aerodynamic forces and moments, Lateral aerodynamic moment, Lateral damping moment and longitudinal moment of a rocket-Lift and drag forces, Drag estimation, Body upwash and downwash in missiles, Rocket dispersion.

UNIT - III

TWO-DIMENSIONAL ROCKET MOTION IN VACUUM: Equations of motion, Rocket Motion in free space (Tsiokovsky's equation, Rocket Parameters, Burnout range), Rocket Motion in a homogeneous gravitational field (Vertical flight, Constant Pitch angle, Gravity turns).

MULTI-STAGE ROCKET: Nomenclature of the multi-stage rocket, Ideal Velocity of the multi-stage rocket, Vertical ascent in a homogeneous gravitational field and in vacuum (Burnout velocity- Culmination altitude-Vertical ascent of a two-stage rocket).

UNIT - IV

ATTITUDE CONTROL OF ROCKETS AND MISSILES: Rocket thrust vector control, Methods of thrust vector control, Thrust magnitude control, Thrust Termination.

SEPARATION SYSTEMS FOR ROCKETS AND MISSILES: Stage separation dynamics, Separation techniques.

UNIT - V

MATERIALS FOR ROCKETS AND MISSILES: Criteria for Selection of materials for rockets and missiles, Choice of materials at cryogenic temperatures, extremely high temperatures. Requirement of materials for thermal protection and pressure vessels.

TEXT BOOKS:

1. Martin J. L. Turner (2008), *Rocket and Spacecraft Propulsion principles, practice and new developments,* 3rd edition, Springer, USA.
2. Sutton G.P. (2010), *Rocket Propulsion Elements*, John Wiley / BSP Books, USA.
3. Cornelissse J. W. (1980), *Rocket Propulsion and Space Dynamics*, Pitman Publishing, London.

REFERENCE BOOKS:

1. S. S. Chin (1982), *Missile Configuration Design*, McGraw- Hill, New Delhi.
2. Bong Wie (2008), *Space Vehicle Dynamics and Control*, AIAA Educatioal Series, USA.
3. Earl R Parker (1998), *Materials for Missiles and Spacecraft*, McGraw Hill, New Delhi.

B. Tech. AE VIII SEMESTER

PROPELLANT TECHNOLOGY
(Professional Elective - III)

Course Code: **A1742**

L	T	P	C
3	1	-	4

UNIT - I

LIQUID FUELS: Properties and tests for petroleum products, Motor gasoline, Aviation gasoline, Aviation turbine fuels, Requirements of aviation fuels of kerosene type and high flash point type, Requirements for fuel oils.

UNIT - II

SOLID PROPELLANTS - I: Single base propellants, Double base propellants, Composite propellants, CMBD propellants, Metallized composite propellants. Introduction to different fuels and oxidizers of composite propellants. Brief introduction to composite theory of composite and double base propellants.

UNIT - III

CRYOGENIC PROPELLANTS - I: Introduction to cryogenic propellants, Liquid hydrogen, liquid oxygen, liquid nitrogen and liquid nitrogen and liquid helium and their properties.

THEORY: Behind the production of low temperature, Expansion engine, Cascade process, Joule Thompson effect, Magnetic effect, Ortho and para H2, Helium 4 and Helium 3. Ideal cycles and efficiency of cryo systems, Storing of cryogenic propellants, Cryogenic loading problems.

UNIT - IV

LIQUID PROPELLANTS - I: Various liquid propellants and their properties, Monopropellants and bipropellant system, concept of ullage, Ignition studies of liquid propellants. Propellant loading tolerances, inventory, Volume versus mass loading. Loading measurement and control, Outage control.

UNIT - V

PROPELLANT TESTING: Laboratory testing, Arc Image Furnace, Ignitability studies. Differential Thermal Analysis, Thermo-gravimetric analysis, Particle size measurement Micro-merograph, Strand burner tests impulse bomb, Performance estimation.

TEXT BOOKS:

1. Cornelissse J. W. (1980), *Rocket Propulsion and Space Dynamics*, Pitman Publishing, London.

REFERENCE BOOKS:

1. Shutton, G. P. (2010), *Rocket Propulsion Elements*, John Wiley / BSP Books, USA.
2. Samir Sarkar (2009), *Fuels and Combustion*, 3rd edition, Universities Press /CRC Press, New York.
3. Mathur M, Sharma R. P. (2010), *Gas Turbine and Jet and Rocket Propulsion,* Standard Publishers, New Delhi.

B. Tech. AE VIII SEMESTER

HELICOPTER ENGINEERING

(Professional Elective - III)

Course Code: **A1743**

L	T	P	C
3	1	-	4

UNIT - I

ELEMENTS OF HELICOPTER AERODYNAMICS: Configurations based on torque reaction, Jet rotors and compound helicopters.

ROTOR CONTROL: Methods of control, Collective and cyclic pitch changes, Lead-lag and flapping hinges.

UNIT - II

IDEAL ROTAR THEORY: Hovering performances, Momentum and simple blade element theories.

ROTOR PERFORMANCE: Figures of merit, Profile and induced power estimation, Constant chord and ideal twist rotors.

UNIT - III

POWER ESTIMATES: Induced, Profile and Parasite power requirements in forward flight, Performances curves with effects of altitude.

STABILITY AND TRIM: Preliminary ideas on helicopter stability.

UNIT - IV

LIFT AND CONTROL OF V/S TOL AIRCRAFT: Various configuration, Propeller, Rotor ducted fan and jet lift, Tilt wing and vectored thrust, Performances of VTOL and STOL aircraft in hover, Transition and Forward motion.

UNIT - V

GROUND EFFECT MACHINES: Types, Hover height, Lift augmentation and power calculations for plenum chamber and peripheral jet machines. Drag of hovercraft on land and water. Applications of hovercraft.

TEXT BOOKS:

1. Johnson Wayne (2011), *Helicopter Theory*, 1st edition, Sterling Publishing House, New York.
2. McCormick B. W. (2010), *Aerodynamics, Aeronautics and Flight Mechanics,* 2nd edition, Wiley India Ltd, New Delhi, India.

REFERENCES BOOKS:

1. Alfred Gessow, Garry C. Myers (2007), *Aerodynamics of Helicopter*, 2nd edition, F. Ungar Pub. Co, New York.
2. McCormick B.W. (1998), *Aerodynamics of V/STOL Flight*, Dover Publications, USA.
3. John M. Seddon (2011), *Basic Helicopter Aerodynamics*, John Wiley & Sons, USA.

B. Tech. AE VIII SEMESTER

DESIGN OF AIRCRAFT STRUCTURES

(Professional Elective - III)

Course Code: **A1744**

L	T	P	C
3	1	-	4

UNIT - I

OVERVIEW OF THE AIRCRAFT DESIGN PROCESS: Introduction, Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies.

FUNDAMENTALS OF STRUCTURAL ANALYSIS: Review of Hooke's Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant's Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations.

INTRODUCTION TO AIRCRAFT STRUCTURES: Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints.

UNIT - II

AIRCRAFT LOADS: Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads.

AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES : Material selection criteria, Aluminum Alloys, Titanium Alloys, Steel Alloys, Magnesium Alloys, copper Alloys, Nimonic Alloys, Non Metallic Materials, Composite Materials, Use of Advanced materials Smart materials, Manufacturing of A/C structural members, Overview of Types of manufacturing processes for Composites, Sheet metal Fabrication ,Machining, Welding, Super plastic Forming And Diffusion Bonding.

UNIT - III

STRUCTURAL ANALYSIS OF AIRCRAFT STRUCTURES: Theory of Plates, Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear.

SAMPLE EXERCISES: Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress.

SAMPLE EXERCISES: Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams, Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams.

SAMPLE EXERCISES: Theory of Torsion- Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections.

UNIT - IV

AIRWORTHINESS AND AIRCRAFT CERTIFICATION: Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements.

UNIT - V

AIRCRAFT STRUCTURAL REPAIR: Types of Structural damage, Nonconformance, Rework, Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices.

TEXT BOOKS:

1. Daniel P. Raymer(2012), *Aircraft Design-A Conceptual Approach*, 5th edition, AIAA Education Series, USA.
2. Michael Niu (2006), *Airframe Structural Design*, 3rd edition, Conmilit Press, New York.
3. Michael Niu (2007), *Airframe Stress Analysis and Sizing* , 2nd edition, Conmilit Press, New York.

REFERENCE BOOKS:

1. Roger D. Schaufele (2007), *The Elements of Aircraft Preliminary Design,* Aries Publications, New York.
2. Frank Delp, Michael J. Kroes, William A. Watkins(2002), *Aircraft Maintenance and Repair*, 6th edition, McGraw Hill, New Delhi.
3. T. H. G. Megson (2010), *Introduction to Aircraft Structural Analysis*, Utterworth - Heinemann Publications, New Delhi, India.
4. B. K. Donaldson (2012), *Analysis of Aircraft Structures,* Cambridge Universities Press , USA.

B. Tech. AE VIII SEMESTER

HYDRAULICS AND PNEUMATICS SYSTEMS

(Professional Elective - III)

Course Code: **A1745**

L	T	P	C
3	1	-	4

UNIT - I

INTRODUCTION TO HYDRAULIC POWER: Pascal's law and problems on Pascal's Law, continuity equations, introduction to conversion of units. Structure of Hydraulic Control System. The Source of Hydraulic Power: Pumps Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. Variable displacement pumps.

HYDRAULIC ACTUATORS AND MOTORS: Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.

UNIT - II

CONTROL COMPONENTS IN HYDRAULIC SYSTEMS: Directional Control Valves, Symbolic representation, Constructional features, pressure control valves, direct and pilot operated types, flow control valves.

HYDRAULIC CIRCUIT DESIGN AND ANALYSIS: Control of single and double, acting Hydraulic Cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits.

UNIT - III

MAINTENANCE OF HYDRAULIC SYSTEMS: Hydraulic oils; Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting.

INTRODUCTION TO PNEUMATIC CONTROL: Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. Pneumatic Actuators: Linear cylinders, Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod–less cylinders, types, working advantages. Rotary cylinder types construction and application. Design parameters, selection.

UNIT - IV

DIRECTIONAL CONTROL VALVES: Symbolic representation as per ISO 1219 and ISO 5599. Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, use of memory valve. Flow control valves and speed control of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve. Signal processing elements: Use of Logic gates – OR and AND gates pneumatic applications. Practical examples involving the use of logic gates. Pressure dependent controls types construction, practical applications. Time dependent controls Principle, construction, practical applications.

UNIT - V

MULTI-CYLINDER APPLICATIONS: Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. Cascading method principle. Practical application examples (up to two cylinders) using cascading method (using reversing valves). Electro-Pneumatic control: Principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications. Compressed air: Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout.

TEXT BOOKS:

1. Anthony Esposito (2009), *Fluid Power with applications*, 7th edition, Pearson education, New Delhi.
2. Andrew Parr (2011), *Hydraulics and Pneumatics: A Technician's and Engineer's Guide*, 3rd edition, Elsevier, USA.

REFERENCE BOOKS:

1. S. R. Majumdar (2002), *Oil Hydraulic Systems - Principles and Maintenance*, Tata McGraw Hill, New Delhi.
2. S. R. Majumdar (2010), *Pneumatic Systems: Principles and Maintenance*, Tata McGraw Hill, New Delhi.
3. John J. Pippenge (1999), *Industrial Hydraulics*, McGraw- Hill, New Delhi.

B. Tech. AE VIII SEMESTER

AIR LINE MANAGEMENT
(Professional Elective - III)

Course Code: **A1746**

L	T	P	C
3	1	-	4

UNIT - I

AIRLINE INDUSTRY: Structure of Airline Industry (Domestic & International), Growth and Regulation, Deregulation, Major and National Carriers, Regional Carriers, Economic characteristics of the Airlines.

AIRLINE MANAGEMENT AND ORGANIZATION: Levels of Management, Decision Making, Functions of Management, Staff Departments, Line Departments.

UNIT - II

INTRODUCTION TO AIRLINE PLANNING: Airline Planning Process, Airline Terminology and Measures: airline demand, airline supply, average load factor, unit revenue, Airline Planning decisions: Fleet Planning, Route evaluation, Schedule development, Pricing, Revenue Management.

FLEET PLANNING AND ROUTE EVALUATION: Factors in Fleet Planning, Hub and Spoke System, Technical Aspects, Fleet Rationalization, Fleet Commonality, Long Range Aircraft, Noise Restrictions, Factors in Design and Development, Fleet Planning Process; Route Evaluation in Hub Networks, Route profitability estimation issues, Demand Driven Dispatch.

UNIT - III

AIRLINE SCHEDULING: The Mission of Scheduling, Equipment Maintenance, Flight Operations and Crew Scheduling, Ground Operations and Facility Limitations, Schedule Planning and Coordination, Equipment Assignment and Types of Schedules, Hub and Spoke Scheduling, Data Limitations in Airline Scheduling.

AIRLINE PRICING, DEMAND AND OUTPUT: Airline pricing and demand, Determinants of demand, changes in demand, Elasticity of demand, determinants of elasticity; Types of passenger fares, Pricing process. Airline costs, Pricing and output determination.

UNIT - IV

AIR CARGO: Introduction, Market for airfreight, Types of airfreight rates: general commodity rates, specific commodity rates, Exception rates, joint rates, priority reserves air freight, speed package service, container rates, specific air freight services, assembly service, distribution service, pickup and delivery service. Factors affecting the air freight rates: costs of service, volume of traffic, directionality ,characteristics of traffic, value of service, competition.

UNIT - V

REVENUE MANAGEMENT: Revenue management objectives, Air line revenue maximization. Differential Pricing, Yield management, Revenue management techniques, Flight over booking, Flight leg revenue management, Origin, Destination control.

TEXT BOOKS:

1. Alexander T. Wells, John G. Wensveen (2008), *Air Transportation: A Management Perspective*, 8th edition, Ashgate Publishing, New Delhi.
2. Charles Banfe (1992), *Airline Management*, Prentice Hall, New York.

REFERENCE BOOKS:

1. Stephen Shaw (2011), *Airline Marketing and Mangement*, 7th edition, Ashgate Publishing, New Delhi.
2. Massond Bazargan (2012), *Airline Operations and Scheduling*, 2nd edition, Ashgate Publishing, New Delhi.

B. Tech. AE VIII SEMESTER

COMPUTATIONAL ANALYSIS OF AIRCRAFT STRUCTURES LAB

Course Code: **A1747**

L	T	P	C
-	-	6	2

LIST OF EXPERIMENTS:

1. Landing gear
2. Aerofoil and Wings
3. Propeller shaft and blades
4. Fuselage
5. Nose cone
6. Nozzles
7. Final Assembly

Note: Analysis of the Aircraft components using Ansys

B. Tech. AE VIII SEMESTER

TECHNICAL SEMINAR

Course Code: **A1748**

L	T	P	C
-	-	6	2

1. OBJECTIVE:

Seminar is an important component of learning in an Engineering College, where the student gets acquainted with preparing a report & presentation on a topic.

2. **PERIODICITY / FREQUENCY OF EVALUATION: Twice**

3. PARAMETERS OF EVALUATION:

1. The seminar shall have two components, one chosen by the student from the course-work without repetition and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work.
2. The two components of the seminar are distributed between two halves of the semester and are evaluated for 50 marks each. The average of the two components shall be taken as the final score.
3. The students shall be required to submit the rough drafts of the seminar outputs within one week of the commencement of the class work.
4. Supervisor shall make suggestions for modification in the rough draft. The final draft shall be presented by the student within a week thereafter.
5. Presentation schedules will be prepared by different Departments in line with the academic calendar.

The Seminars shall be evaluated in two stages as follows:

A. Rough draft

In this stage, the student should collect information from various sources on the topic and collate them in a systematic manner. He/ She may take the help of the concerned supervisor.

The report should be typed in “MS-Word” file with “calibri” font, with font size of 16 for main heading, 14 for sub-headings and 11 for the body text. The contents should also be arranged in Power Point Presentation with relevant diagrams, pictures and illustrations. It should normally contain 18 to 25 slides, consisting of the followings:

1.	Topic, name of the student & guide	1 Slide
2.	List of contents	1 Slide
3.	Introduction	1 - 2 Slides
4.	Descriptions of the topic (point-wise)	7 - 10 Slides
5.	Images, circuits etc.	6 - 8 Slides
6.	Conclusion	1 - 2 Slides
7.	References/Bibliography	1 Slide

The soft copy of the rough draft of the seminar presentation in MS Power Point format along with the draft Report should be submitted to the concerned supervisor, with a copy to the concerned HOD within 30 days of the commencement of class work.

The evaluation of the Rough draft shall generally be based upon the following.

1.	Punctuality in submission of rough draft and discussion	2 Marks
2.	Resources from which the seminar have been based	2 Marks
3.	Report	3 Marks
4.	Lay out, and content of Presentation	3 Marks
5.	Depth of the students knowledge in the subject	5 Marks
Total		15 Marks

After evaluation of the first draft the supervisor shall suggest further reading, additional work and fine tuning, to improve the quality of the seminar work.

Within 7 days of the submission of the rough draft, the students are to submit the final draft incorporating the suggestions made by the supervisor.

B. Presentation:

After finalization of the final draft, the students shall be allotted dates for presentation (in the designated seminar classes) and they shall then present it in presence students, supervisor, faculties of the department and at least one faculty from some department / other department.

The student shall submit 3 copies of the Report neatly bound along with 2 soft copies of the PPT in DVD medium. The students shall also distribute the title and abstract of the seminar in hard copy to the audience. The final presentation has to be delivered with 18-25 slides.

The evaluation of the Presentation shall generally be based upon the following.

1.	Contents	10 Marks
2.	Delivery	10 Marks
3.	Relevance and interest the topic creates	5 Marks
4.	Ability to involve the spectators	5 Marks
5.	Question answer session	5 Marks
Total		35 Marks

4. WHO WILL EVALUATE?

The presentation of the seminar topics shall be made before an internal evaluation committee comprising the Head of the Department or his/her nominee, seminar supervisor and a senior faculty of the department / other department.

B. Tech. AE VIII SEMESTER

COMPREHENSIVE VIVA

Course Code: **A1749**

L	T	P	C
-	-	-	2

1. OBJECTIVE:

- To enable the examiners to assess the candidate's knowledge in his or her particular field of learning.
- To test the student's awareness of the latest developments and relate them to the knowledge acquired during the classroom teaching.

2. PARAMETERS OF EVALUATION:

Subject Knowledge	Current Awareness	Career Orientation	Communication Skills	Total
20	10	10	10	50

3. WHO WILL EVALUATE?

The comprehensive Viva will be conducted by a committee comprising Head of the Department or his/her nominee, two senior faculty of the respective department and an external examiner from outside the college. The comprehensive viva shall be evaluated for 50 marks at the end of VIII semester. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

4. **PERIODICITY / FREQUENCY OF EVALUATION: Once**

5. PEDAGOGY:

- The viva will be held on a face to face basis.
- The students will be expected to answer the questions related to latest developments and all courses taken till date.
- Viva voce will be conducted within week before the beginning of midterm examinations. However, in exceptional circumstances it can be scheduled immediately after the end of midterm examinations.
- Students will have to make themselves available on the date of the viva voce.

B. Tech. AE VIII SEMESTER

MINI PROJECT / PROJECT WORK

Course Code: **A1750/ A1733**

L	T	P	C
-	-	12	8

1. OBJECTIVE:

The main objective of the Project Work is for the students to learn and experience all the major phases and processes involved in solving "real life engineering problems".

2. EXPECTED OUTCOME:

The major outcome of the B. Tech project must be well-trained students. More specifically students must have acquired:

- System integration skills
- Documentation skills
- Project management skills
- Problem solving skills

2. PROJECT SELECTION:

Projects are suggested by the faculty, with or without collaboration with an industry. All faculty are to suggest projects. Students are also encouraged to give project proposals after identifying a faculty who would be willing to supervisor the work. A Project brief is to be given by the faculty to the group defining the project comprehensively.

All B. Tech major projects are to be done in the Institute. For industry specified projects, students will be permitted to spend 1-2 weeks in the industry on recommendation by the supervisor. The number of students per batch should be between 2 and 4. If more number of students is really needed, the project may be split into functional modules and given to subgroups.

4. WHO WILL EVALUATE?

The end semester examination shall be based on the report submitted and a viva-voce exam for 150 marks by committee comprising of the Head of the Department, project supervisor and an external examiner.

5. EVALUATION:

The basic purpose is to assess the student competencies with regard to his project work. More specifically to assess the student's individual contribution to the project, to establish the level of understanding of basic theoretical knowledge relevant to the project and to ensure that the student has good understanding and appreciation of design and development decisions taken in the course of the project. It is desirable that all faculty members are present for the evaluations as this is a platform to get to know the student projects and to motivate the students to do good projects. The faculty should adopt a clear and consistent pattern of asking questions from general to specific aspects of the project. The presentation and evaluation is open to other students of the department.

The project work shall be evaluated for 200 marks out of which 50 marks for internal evaluation and 150 marks for end-semester evaluation. The evaluation shall be done on the following basis

Semester VII	**Semester VIII**
Preliminary Evaluation - 10 marks	Design Evaluation II - 25 marks
Design Evaluation I - 15 marks	Final Evaluation – 150 marks

6. GUIDELINES FOR THE PREPARATION OF B. TECH PROJECT REPORTS

1.1. Project reports should be typed neatly only on one side of the paper with 1.5 or double line spacing on a A4 size bond paper (210 x 297 mm). The margins should be: Left - 1.25", Right - 1", Top and Bottom - 0.75".

1.2. The total number of reports to be prepared are:

- One copy to the department
- One copy to the concerned guide(s)
- One copy to the candidate.

1.3. Before taking the final printout, the approval of the concerned guide(s) is mandatory and suggested corrections, if any, must be incorporated.

1.4. For making copies dry tone Xerox is suggested.

1.5. Every copy of the report must contain

- Inner title page (White)
- Outer title page with a plastic cover
- Certificate in the format enclosed both from the college and the organization where the project is carried out.
- An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.

6.6. The organization of the report should be as follows:

1.	Inner title page	Usually numbered in roman
2.	Abstract or Synopsis	
3.	Acknowledgments	
4.	Table of Contents	
5.	List of table & figures (optional)	

6.7 Chapters (to be numbered) containing Introduction, which usually specifies the scope of work and its importance and relation to previous work and the present developments, Main body of the report divided appropriately into chapters, sections and subsections.

- The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.
- The report should be typed in "MS-Word" file with "calibri" font. The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 11.
- The figures and tables must be numbered chapter wise for e.g.: Fig. 2.1 Block diagram of a serial binary adder, Table 3.1 Primitive flow table, etc.
- The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

6.8. Reference OR Bibliography: The references should be **numbered serially** in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [3]. The section on references should list them in serial order in the following format.

1. For textbooks - A.V. Oppenheim and R.W. Schafer, Digital Signal Processing, Englewood, N.J., Prentice Hall, 3 Edition, 1975.
2. For papers - Devid, Insulation design to combat pollution problem, Proc of IEEE, PAS, Vol 71, Aug 1981, pp 1901-1907.

6.9. Only SI units are to be used in the report. Important equations must be numbered in decimal form for e.g. **V = IZ** ..... **(3.2)**

6.10. All equation numbers should be right justified.

6.11. The project report should be brief and include descriptions of work carried out by others only to the minimum extent necessary. Verbatim reproduction of material available elsewhere should be strictly avoided. Where short excerpts from published work are desired to be included, they should be within quotation marks appropriately referenced.

6.12. Proper attention is to be paid not only to the technical contents but also to the organization of the report and clarity of the expression. Due care should be taken to avoid spelling and typing errors. The student should note that report-write-up forms the important component in the overall evaluation of the project

6.13. Hardware projects must include: the component layout, complete circuit with the component list containing the name of the component, numbers used, etc. and the main component data sheets as Appendix. At the time of report submissions, the students must hand over a copy of these details to the project coordinator and see that they are entered in proper registers maintained in the department.

6.14. Software projects must include a virus free disc, containing the software developed by them along with the read me file. Read me file should contain the details of the variables used, salient features of the software and procedure of using them: compiling procedure, details of the computer hardware/software requirements to run the same, etc. If the developed software uses any public domain software downloaded from some site, then the address of the site along with the module name etc. must be included on a separate sheet. It must be properly acknowledged in the acknowledgments.

6.15. Sponsored Projects must also satisfy the above requirements along with statement of accounts, bills for the same dully attested by the concerned guides to process further, They must also produce NOC from the concerned guide before taking the internal viva examination.

6.16. The reports submitted to the department/guide(s) must be hard bounded, with a plastic covering.

6.17. Separator sheets, used if any, between chapters, should be of thin paper

VARDHAMAN COLLEGE OF ENGINEERING

(Autonomous)

Shamshabad – 501 218, Hyderabad

Department of ……..

CERTIFICATE

Certified that the project work entitled …….. carried out by Mr./Ms. ……., Roll Number ……, a bonafide student of ……in partial fulfillment for the award of **Bachelor of Technology** in …… of the Jawaharlal Nehru Technological University, Hyderabad during the year …….. It is certified that all corrections / suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

Name & Signature of the Guide **Name Signature of the HOD** **Signature of the Principal**

External Viva

Name of the examiners Signature with date

1.

2.

Certificate issued at the Organization where the project was carried out

(On a separate sheet, If applicable)

NAME OF THE INDUSTRY / ORGANIZATION, Address with pin code

CERTIFICATE

Certified that the project work entitled …….. carried out by Mr./Ms . ……., Roll Number……., a bonafide student of ……in partial fulfillment for the award of **Bachelor of Technology** in …… of the Jawaharlal Nehru Technological University, Hyderabad during the year …….. It is certified that, he/she has completed the project satisfactorily

Name & Signature of the Guide **Name & Signature of the Head of Organization**

7. **DISTRIBUTION OF MARKS FOR B.TECH DISSERTATION EVALUATION**

S No.	Particulars	Max. Marks
1	Relevance of the subject in the present context	**10**
2	Literature Survey	**10**
3	Problem formulation	**20**
4	Experimental observation / theoretical modeling	**10**
5	Results – Presentation & Discussion	**20**
6	Conclusions and scope for future work	**10**
7	Overall presentation of the Thesis / Oral presentation	**40**
8	Project Report Writing	**30**
Total Marks		**150**

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their

	any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Frequently asked Questions and Answers about autonomy

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

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy.

2. Shall VCE award its own Degrees?

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

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

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

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

Autonomous status, once declared, shall be accepted by all the stake holders. Foreign Universities and Indian Industries will know our status through our college website.

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

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

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

There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee is a Non – Statutory body, which will keep a watch on the academics and keep its reports and recommendations every year. In addition to Academic Council, the highest academic body also supervises the academic matters. At the end of three years, there is an external inspection by the University for this purpose. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

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

No. VCE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural and co-curricular organized by the University the students shall qualify.

8. Can VCE have its own Convocation?

No, since the University awards the Degree the Convocation will be that of the University.

9. Can VCE give a provisional degree certificate?

Since the examinations are conducted by VCE and the results are also declared by VCE, the college sends a list of successful candidates with their final percentage of marks to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10. Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment, besides the autonomous status is more responsive to the needs of the industry. As a result, there will be a lot of scope for

industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11. What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 25 % for internal assessment and 75 % for external assessment. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. Will there be any Revaluation or Re-Examination System?

No. There will not be any Revaluation system or Re-examination. But, there is a personal verification of the answer scripts.

13. How fast Syllabi can be and should be changed?

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

14. Will the Degree be awarded on the basis of only final year performance?

No. The percentage of marks will reflect the average performance of all the semesters put together.

15. Who takes Decisions on Academic matters?

The Academic Council of College is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like the BOS which are like Boards of Studies of the University.

16. What is the role of Examination committee?

The Exam Committee is responsible for the smooth conduct of inter and external examinations. All matters involving the conduct of examinations, spot valuations, tabulations, preparation of Memorandum of Marks etc fall within the duties of the Examination Committee.

17. Is there any mechanism for Grievance Redressal?

Yes, the college has grievance redressal committee, headed by a senior faculty member of the college.

18. How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulations.

19. Who declares the result?

The result declaration process is also defined. After tabulation work the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the College Academic Council for its approval. The result is then declared on the college notice boards as well put on the web site of the college. It is eventually sent to the University.

20. What is our relationship with the Jawaharlal Nehru Technological University, Hyderabad?

We remain an affiliated college of the Jawaharlal Nehru Technological University, Hyderabad. The University has the right to nominate its members on the academic bodies of the college.

21. Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

22. Shall we get autonomy for PG and Doctoral Programmes also?

Yes, presently our PG programmes are also enjoying autonomous status.

23. How many exams will be there as an autonomous college?

This is defined in the Rules & Regulations.