HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

(Estd. u/s 3 of the UGC Act, 1956)

Padur, Kancheepuram District - 603 103.

SCHOOL OF
AERONAUTICAL SCIENCES

CURRICULUM
&
SYLLABUS 2013-14

B.Tech.
AERONAUTICAL ENGINEERING

ACADEMIC REGULATIONS (B.Tech)
(Full /Part Time) (Effective 2013-14)

1. Vision, Mission and Objectives

1.1 The Vision of the Institute is "To make every man a success and no man a failure".

In order to progress towards the vision, the Institute has identified itself with a mission to provide every individual with a conducive environment suitable to achieve his / her career goals, with a strong emphasis on personality development, and to offer quality education in all spheres of engineering, technology, applied sciences and management, without compromising on the quality and code of ethics.

1.2 Further, the Institute always strives

- To train our students with the latest and the best in the rapidly changing fields of Engineering, Technology, Management, Science & Humanities.
- To develop the students with a global outlook possessing, state of the art skills, capable of taking up challenging responsibilities in the respective fields.
- To mould our students as citizens with moral, ethical and social values so as to fulfill their obligations to the nation and the society.
- To promote research in the field of Science, Humanities, Engineering, Technology and allied branches.

1.3 Aims and Objectives of the Institute are focused on

- Providing world class education in engineering, technology, applied sciences and management.
- Keeping pace with the ever changing technological scenario to help the students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.
- To inculcate a flair for research, development and entrepreneurship.

2. Admission

2.1 The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, following guidelines issued by Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the B.Tech programme will be decided by BOM as per the directives from MHRD, Government of India and taking into account the market demands. Some seats for Non Resident Indians and a few seats for foreign nationals shall be made available.

2.2 (i) Full-Time :

At the time of applying for admission, the candidates should have passed / appeared and be awaiting results of the final examination of the 10+2 system or its equivalent with Mathematics, Physics and Chemistry as subjects of study.

(ii) Part -Time:

At the time of applying for admission, the candidates should have a Diploma in Engineering/Technology in the relevant branch of specialization awarded by the State Board of Technical Education, Tamil Nadu or any other authority accepted by the Board of Management of the University as equivalent thereto and a minimum of one year practical experience.

2.3 The selected candidates will be admitted to the B.Tech. programme after he/she fulfills all the admission requirements set

by the Institute and after the payment of the prescribed fees.

2.4 In all matters relating to admission to the B.E. / B.Tech. programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.

2.5 If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

3. Structure of the programme

3.1 The programme of instruction will have the following structure:

i) A general (common) core programme comprising basic sciences, engineering sciences, humanities, technical arts and mathematics.

ii) An engineering core programme introducing the student to the foundations of engineering in the respective branch.

iii) An elective programme enabling the student to opt and undergo a set of courses of interest to him/ her.

iv) Professional practice including project, seminar and industrial training.

v) General elective courses, such as, Environmental Studies, Physical Education, Professional ethics, and National Service Scheme.

The distribution of total credits required for the degree programme into the above five categories will nominally be 20%, 50%, 15%, 5%, and 10% respectively.

3.2 (i) Full-Time:

The duration of the programme will be a minimum of 8 semesters. Every branch of the B.E. / B.Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council.

ii) Part - Time:

The duration of the programme will be a minimum of 7 semesters. Every branch of the B.Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council

3.3 The academic programmes of the Institute follow the credit system. The general pattern is:

- One credit for each lecture hour per week per semester;
- One credit for each tutorial hour per week per semester;
- Two credits for each laboratory practical/ drawing of three hours per week per semester.
- One credit for 4 weeks of industrial training and
- One credit for 4 hours of project per week per semester

3.4 (i) Full-Time:

For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits of 190-200.

(ii) Part-Time:

For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits of 110-120.

3.5 The medium of instruction, examination and the language of the project reports will be English.

4. Faculty Advisor

4.1 To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned Department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor.

5. Class Committee

5.1 A Class Committee consisting of the following will be constituted by the Head of the Department for each class:

(i) A Chairman, who is not teaching the class.

(ii) All subject teachers of the class.

(iii) Two students nominated by the department in consultation with the class.

The Class Committee will meet as often as necessary, but not less than three times during a semester.

The functions of the Class Committee will include:

(i) Addressing problems experienced by students in the classroom and the laboratories.

(ii) Analyzing the performance of the students of the class after each test and finding ways and means of addressing problems, if any.

(iii) During the meetings, the student members shall express the opinions and suggestions of the class students to improve the teaching / learning process.

6. Grading

6.1 A grading system as below will be adhered to.

Range of Marks	Letter Grade	Grade points
95 -100	S	10
85 - 94	A	09
75 - 84	B	08
65 -74	C	07
55 - 64	D	06
50 - 54	E	05
< 50	U	00
	I (Incomplete)	–

6.2 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i " and the grade points Pi earned for that course taken over all courses "i" registered by the student to the sum of Ci for all "i ". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, at any semester, considering all the courses enrolled from the first semester onwards.

6.3 For the students with letter grade I in certain subjects, the same will not be included in the computation of GPA and CGPA until after those grades are converted to the regular grades.

6.4 Raw marks will be moderated by a moderation board appointed by the Vice-Chancellor of the University. The final marks will be graded using an absolute grading system. The Constitution and composition of the moderation board will be dealt with separately.

7. Registration and Enrolment

7.1 Except for the first semester, registration and enrollment will be done in the beginning of the semester as per the schedule announced by the University.

7.2 A student will be eligible for enrollment only if he/she satisfies regulation 10 (maximum duration of the programme) and will be permitted to enroll if (i) he/she has cleared all dues in the Institute, Hostel and Library up to the end of the previous semester and (ii) he/she is not debarred from enrollment by a disciplinary action of the University.

7.3 Students are required to submit registration form duly filled in.

8. Registration requirement

8.1 (i) Full -Time:

A full time student shall not register for less than 16 credits or more than 30 credits in any given semester.

(ii) Part -Time:

A part time student shall not register for less than 10 credits or more than 20 credits in any given semester

8.2 If a student finds his/her load heavy in any semester, or for any other valid reason, he/she may withdraw from the courses within three weeks of the commencement of the semester with the written approval of his/her Faculty Advisor and HOD. However the student should ensure that the total number of credits registered for in any semester should enable him/her to earn the minimum number of credits per semester for the completed semesters.

9. Continuation of the programme

9.1 For those students who have not earned the minimum required credit prescribed for that particular semester examination, a warning letter to the concerned student and also to his/her parents regarding the shortage of his/her credit will be sent by the HOD after the announcement of the results of the university examinations.

10. Maximum duration of the programme

10.1 (i) Full - Time

The normal duration of the programme is eight semesters. However a student may complete the programme at a slower pace by taking more time, but in any case not more than 14 semesters excluding the semesters withdrawn on medical grounds or other valid reasons.

(ii) Part - Time

The normal duration of the programme is seven semesters. However a student may complete the programme at a slower pace by taking more time, but in any case not more than 12 semesters excluding the semesters withdrawn on medical grounds or other valid reasons

11. Temporary discontinuation

11.1 A student may be permitted by the Director (Academic) to discontinue temporarily from the programme for a semester or a longer period for reasons of ill health or other valid reasons. Normally a student will be permitted to discontinue from the programme only for a maximum duration of two semesters.

12. Discipline

12.1 Every student is required to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

12.2 Any act of indiscipline of a student reported to the Director (Academic) will be referred to a Discipline Committee so constituted. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also

authorize the Director (Academic) to recommend to the Vice-Chancellor the implementation of the decision. The student concerned may appeal to the Vice-Chancellor whose decision will be final. The Director (Academic) will report the action taken at the next meeting of the Council.

12.3 Ragging and harassment of women are strictly prohibited in the University campus and hostels.

13. Attendance

13.1 A student whose attendance is less than 75% in a semester is not eligible to appear for the end-semester examination for that semester. The details of all students who have less than 75% attendance in a course will be announced by the teacher in the class. These details will be sent to the concerned HODs and Director (Academic).

13.2 Those who have less than 75% attendance will be considered for condonation of shortage of attendance. However, a condonation of 10% in attendance will be given on medical reasons. Application for condonation recommended by the Faculty Advisor, concerned faculty member and the HOD is to be submitted to the Director (Academic) who, depending on the merits of the case, may permit the student to appear for the end semester examination. A student will be eligible for this concession at most in two semesters during the entire degree programme. Application for medical leave, supported by medical certificate with endorsement by a Registered Medical Officer, should reach the HOD within seven days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier.

13.3 As an incentive to those students who are involved in extra curricular activities such as representing the University in Sports and Games, Cultural Festivals, and Technical Festivals, NCC/ NSS events, a relaxation of up to 10% attendance will be given subject to the condition that these students take prior approval from the officer - in-charge. All such applications should be recommended by the concerned HOD and forwarded to Director (Academic) within seven instructional days after the programme / activity.

14. Assessment Procedure

14.1 The Academic Council will decide from time to time the system of tests and examinations in each subject in each semester.

14.2 For each theory course, the assessment will be done on a continuous basis as follows:

Test / Exam	Weightage	Duration of Test / Exam
First Periodical Test *	10%	2 Periods
Second Periodical Test *	10%	2 Periods
Model Exam	20%	3 hours
Seminar/Assignments/Quiz	10%	-
Attendance	10%	
End - semester examination	50%	3 Hours

*Best out of the two tests will be considered.

14.3 For practical courses, the assessment will be done by the subject teachers as below:

(i) Weekly assignment/Observation note book / lab records - weightage 60%.

(ii) End semester examination of 3 hours duration including viva - weightage 40%.

14.4 For courses on Physical Education, NSS, etc the assessment will be as satisfactory/not satisfactory only.

15. Make up Examination/Model Exam

15.1 Students who miss the end-semester examinations / model examination for valid reasons are eligible for make-up examination /model examination. Those who miss the end-semester examination / model examination should apply to the Head of the Department concerned within five days after he / she missed examination, giving reasons for absence.

15.2 Permission to appear for make-up examination / model examination will be given under exceptional circumstances such as admission to a hospital due to illness. Students should produce a medical certificate issued by a Registered Medical Practitioner certifying that he/she was admitted to hospital during the period of examination / model exam and the same should be duly endorsed by parent / guardian and also by a medical officer of the University within 5 days.

16. Project evaluation

16.1 For Project work, the assessment will be done on a continuous basis as follows:

Review / Examination	Weightage
First Review	10%
Second Review	20%
Third Review	20%
End-semester Examination	50%

For end-semester examination, the student will submit a Project Report in a format specified by the Director (Academic). The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end-semester examination will be conducted by a Committee constituted by the Registrar / Controller of examination. This will include an external expert.

17. Declaration of results

17.1 A candidate who secures not less than 50% of total marks prescribed for a course with a minimum of 50% of the marks prescribed for the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

(ii) To be Eligible to appear for the end semester examinations for a particular course, a candidate will have to secure a minimum of 40% marks in the sessional for that course.

(iii) Candidates are required to obtain all credits assigned to the first two semesters of the programme within the first four semesters of the programme. Candidates failing to satisfy this requirement will not be allowed to proceed to the fifth semester until the condition is satisfied. Further, candidates will not be allowed to proceed to seventh semester if they have not cleared all the courses assigned during third & fourth semesters.

17.2 After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of UG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The minutes of the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After

getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/ Registrar.

17.3 If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end-semester examination, he/she shall register and re-appear for the end-semester examination during the following semester. However, the sessional marks secured by the candidate will be retained for all such attempts.

17.4 If a candidate fails to secure a pass in a course due to insufficient sessional marks though meeting the minimum requirements of the end-semester examination, and wishes to improve on his/her sessional marks, he/she will have to register for the particular course and attend the course with permission of the HOD concerned and Director(Academic) with a copy marked to the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

17.5 A candidate can apply for the revaluation of his/her end-semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/ Controller of Examinations through the Head of the Department. The Registrar/ Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

17.6 After ten semesters, the sessional marks of the candidate will not be considered for a pass in a course. A candidate who secures 50% in the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

18. Grade Card

18.1 After results are declared, grade sheet will be issued to each student which will contain the following details:

(i) Program and branch for which the student has enrolled.

(ii) Semester of registration.

(iii) List of courses registered during the semester and the grade scored.

(iv) Semester Grade Point Average (GPA)

(v) Cumulative Grade Point Average (CGPA).

19. Class/Division

19.1 Classification is based on CGPA and is as follows:

CGPA $\geq$ 8.0: **First Class with distinction**

6.5 $\leq$ CGPA < 8.0 : **First Class**

5.0 $\leq$ CGPA < 6.5 : **Second Class.**

19.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance within the minimum duration of the programme.

(ii) The award of 'First Class' is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses **within 10 semesters.**

(iii) The period of authorized discontinuation of the programme (vide clause 11.1) will not be counted for the purpose of the above classification.

20. Transfer of credits

20.1. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the

transfer of credits committee so consulted by the Chancellor may permit students to earn part of the credit requirement in other approved institutions of repute and status in the country or abroad.

20.2 The Academic Council may also approve admission of lateral entry (who hold a diploma in Engineering/ technology) candidates with advance credit based on the recommendation of the transfer of credits committee on a case to case basis.

21. Eligibility for the award of B.Tech. Degree

21.1. A student will be declared to be eligible for the award of the B.Tech. Degree if he/she has

i) registered and successfully acquired the credits for the core courses;

ii) successfully acquired the credits in the different categories as specified in the curriculum corresponding to the discipline (branch) of his/her study within the stipulated time;

iii) has no dues to all sections of the Institute including Hostels, and

iv) has no disciplinary action pending against him/her.

The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

22. Change of Branch

22.1 If the number of students in any branch of B.Tech. class as on the last instructional day of the First Semester is less than the sanctioned strength, then the vacancies in the said branches can be filled by transferring students from other branches. All such transfers will be allowed on the basis of merit of the students. The decision of the Chancellor shall be final while considering such requests.

22.2 All students who have successfully completed the first semester of the course will be eligible for consideration for change of branch subject to the availability of vacancies.

23. Power to modify

23.1. Notwithstanding all that has been stated above, the Academic Council shall modify any of the above regulations from time to time subject to approval by the Board of Management.

HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

SCHOOL OF AERONAUTICAL SCIENCES

B.TECH. AERONAUTICAL ENGINEERING

OBJECTIVES OF THE PROGRAMME

- To educate the students in the fundamentals of engineering, science and their applications to important practical problems using design, analysis and synthesis of aircraft components, systems and tools through basic and advance research.
- To inspire our students to pursue a life of curiosity and desire for learning and to instill in them the ability and self confidence to adopt rapid and major changes.
- To develop leadership skills in our students necessary to shape the social, intellectual, business and technical worlds.

PROGRAMME OUTCOME

- The student will have the ability to apply knowledge of engineering, science and mathematics to design and conduct experiments in the field of Aeronautical Engieering.
- The students will have the ability to design a system, component or process to meet desired needs and to function in multidisciplinary teams.
- The students will become a professional engineer with all necessary skills, personality and sound knowledge in basic and advance research areas.

HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

SCHOOL OF AERONAUTICAL ENGINEERING

Semester I

(Common to all Branches)

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1.	EL 2101	Technical English	3	0	0	3	3
2.	MA 2101	Engineering Mathematics-I	3	1	0	4	4
3.	PH 2001/ CY 2001	Engineering Physics Engineering Chemistry *	3	0	0	3	3
4.	ME 2101	Engineering Graphics	1	0	3	3	4
5.	CS 2101	Computer Programming	3	0	0	3	3
PRACTICAL							
1.	CS2131	Computer Programming Laboratory	0	0	3	2	3
2	GE 2131	Engineering Practices Laboratory-I	0	0	3	2	3
3.	EL 2131	Communication Skills Laboratory I	0	0	3	2	3
4	PH 2031/ CY 2031	Physics Laboratory / Chemistry Laboratory *	1	0	3	3	4
		Total				**25**	**30**

* Depending upon the number of batches, it will be alternated between Semesters 1 & 2

Semester – II

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MA 2201	Engineering Mathematics-II #	3	1	0	4	4
2	CY 2001/ PH 2001	Engineering Chemistry / Engineering Physics * #	3	0	0	3	3
3	AE 2201	Solid Mechanics	3	1	0	4	4
4	AE 2202	Engineering Mechanics	3	1	0	4	4
5	CY 2002	Environmental Science and Engineering **	3	0	0	3	3
PRACTICAL							
1	CY 2031/ PH 2031	Chemistry Laboratory / Physics Laboratory * #	1	0	3	3	4
2	EL 2231	Communication skills laboratory-II #	2	0	2	3	4
3	GE 2231	Engineering Practices Laboratory-II #	0	0	3	2	3
4	AE 2231	Strength of materials Laboratory	0	0	3	2	3
		Total				**28**	**32**

Note: * Depending upon the number of batches, it will be alternated between Semesters 1 & 2

Common to all Branches

** Common to Automobile, Aeronautical, Electronics & Instrumentation, Mechanical Engineering

Semester – III

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MA 2301	Engineering Mathematics III *	3	1	0	4	4
2	AE 2301	Elements of Aeronautics	3	0	0	3	3
3	AE 2302	Aero Engineering Thermodynamics	3	1	0	4	4
4	AE 2303	Fluid Mechanics and Machinery	3	1	0	4	4
5	AE 2304	Aircraft Materials	3	0	0	3	3

PRACTICAL							
1	AE 2331	Workshop Practices Lab	0	0	3	2	3
2	AE 2332	Fluid Mechanics and Machinery Lab	0	0	3	2	3
3	AE 2333	Design & Drafting Laboratory	0	0	3	2	3
4	AE 2334	Thermodynamics Lab	0	0	3	2	3
		Total				**26**	**30**

*Common to Automobile, Aeronautical, Mechanical Engineering

Semester - IV

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MA 2401	Numerical Methods*	3	1	0	4	4
2	AE 2401	Aircraft Systems & Instruments	3	0	0	3	3
3	AE 2402	Mechanics of Machines	3	1	0	4	4
4	AE 2403	Aircraft Structure-I	3	1	0	4	4
5	AE 2404	Aerodynamics-I	3	1	0	4	4
PRACTICAL							
1	AE 2431	Computer Aided Design and Modelling Lab	0	0	3	2	3
2	AE 2432	Aircraft Structures Laboratory	0	0	3	2	3
3	AE 2433	Aerodynamics Laboratory	0	0	3	2	3
4	AE 2434	Project Work	0	0	6	2	6
		Total				**27**	**34**

* Common to Aeronautical, Civil, Mechanical Engineering

Semester - V

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	EC 2512	Micro processor & Applications	3	0	0	3	3
2	AE 2501	Propulsion-I	3	1	0	4	4
3	AE 2502	Aerodynamics-II	3	1	0	4	4
4	AE 2503	Aircraft Structure-II	3	1	0	4	4

5	Elective -I		3	0	0	3	3
6	Elective-II		3	0	0	3	3
PRACTICAL							
1	AE 2531	Propulsion Laboratory	0	0	3	2	3
2	AE 2532	Aircraft Structural Repair Laboratory	0	0	3	2	3
		Total				**25**	**27**

Semester - VI

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	AE 2601	Flight Dynamics	3	1	0	4	4
2	AE 2602	Control Engineering	3	1	0	4	4
3	AE 2603	Experimental Stress Analysis	3	0	0	3	4
4	AE 2604	Propulsion -II	3	1	0	4	4
5	Elective-III		3	0	0	3	3
PRACTICAL							
1	AE 2631	Aircraft Design Project	0	0	3	2	3
2	AE 2632	Aircraft Systems Laboratory	0	0	3	2	3
3	EL 2431	Communication skills and Personality Development	2	0	2	3	4
		Total				**25**	**29**

Semester - VII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	AE 2701	Heat transfer	3	1	0	4	4
2	AE 2702	High Temperature Materials	3	1	0	4	4
3	AE 2703	Composite Materials and Structures	3	1	0	4	4
4	AE 2704	Avionics	3	0	0	3	3

5	AE 2705	Rockets & missiles	3	1	0	4	4
6		Elective-IV	3	0	0	3	3
PRACTICAL							
1	AE 2731	Avionics Laboratory	0	0	3	2	3
2	AE 2732	Aero Engine Repair And Maintenance Laboratory	0	0	3	2	3
		Total				**26**	**28**

Semester - VIII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	Elective VI		3	0	0	3	3
PRACTICAL							
1	AE 2831	Project & Viva-voce	0	0	24	6	24
		Total				**9**	**27**

TOTAL CREDITS = 191

LIST OF ELECTIVES - V

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	AE 2551	Computer Integrated Manufacturing	3	0	0	3	3
2	GE 2001	Professional Ethics and Human Values*	3	0	0	3	3
3	AE 2552	Aircraft Design	3	0	0	3	3
4	AE 2553	Civil Aviation Requirement-I	3	0	0	3	3
5	AE 2554	Aircraft General Engineering and Maintenance Practices	3	0	0	3	3

* Common to Aeronautical, Civil, Mechanical Engineering

LIST OF ELECTIVES - VI

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	AE 2651	Finite Element Method	3	0	0	3	3
2	AE 2652	Air Transportation and Aircraft Maintenance	3	0	0	3	3
3	AE 2653	Airframe Maintenance and Repair Practices	3	0	0	3	3
4	MG2002	Total Quality Management*	3	0	0	3	3
5	AE 2654	Civil Aviation Requirement-II	3	0	0	3	3

* Common to Automobile, Aeronautical, Civil, Electronics & Instrumentation, Mechanical Engineering

LIST OF ELECTIVES - VII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	AE 2751	Wind Tunnel Techniques	3	0	0	3	3
2	AE 2752	Vibration and Aero Elasticity	3	0	0	3	3
3	AE 2753	Fatigue and Fracture Mechanics	3	0	0	3	3

LIST OF ELECTIVES - VIII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	AE 2851	Computational Fluid Dynamics	3	0	0	3	3
2	AE 2852	Aero Engine Maintenance and Repair	3	0	0	3	3
3	AE 2853	Helicopter Maintenance	3	0	0	3	3

SEMESTER I

EL 2101 TECHNICAL ENGLISH

L	T	P	C
3	0	0	3

GOAL

The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their workplace or living space; to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES

The course should enable the students to :

1. Widen the capacity of the learners to listen to English language at the basic level and understand its meaning.
2. Enable learners to communicate in an intelligible English accent and pronunciation.
3. Assist the learners in reading and grasping a passage in English.
4. Learn the art of writing simple English with correct spelling, grammar and punctuation.
5. Cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

OUTCOME

The students should be able to :

1. Develop the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use itfor daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts.
4. Write instructions, recommendations, checklists, process-description, letter-writing and report writing.
5. Develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.

UNIT I LISTENING SKILL 9

Listening to short and extended dialogues, telephone conversations, discussions, soliloquies - Listening to prose & poetry reading -- Listening to sounds, silent letters, stressed syllables in English -- Listening to video clips, documentaries, feature films, presentations, interviews -- Listening for the gist of the text, for identifying a topic, general meaning and specific information -- Listening for multiple-choice questions, for positive & negative comments, for interpretation -- Listening for advanced interpretation.

UNIT II SPEAKING SKILL **9**

Introducing oneself or expressing personal opinion -- Simple oral or casual interaction - Dialogue -- Conversation - Giving and receiving feedback using Johari window - Debates -- Brief presentations -- Differences between disagreeing and being disagreeable -- Participating in group discussions, role plays and interviews -- Generating talks based on visual or written prompts -- Addressing a small group or a large formal gathering - Comparing, contrasting, justifying, agreeing and disagreeing on advanced topics - Speaking about present and past experiences and future plans - Debates, discussions and role plays on advanced topics - Job interviews - Preparing HR questions with possible answers -- Brief presentations - Arguing out a topic without verbal fights -- Power point presentation.

UNIT III READING SKILL **9**

Reading for skimming and scanning -- Reading for the gist of a text, for specific information, for information transfer and interpretation -- Reading and interpreting anecdotes, short stories, poems, prose passages for intellectual and emotional comments - Reading a Fishbone diagram for strengths and weaknesses, for pros and cons - Reading comprehension exercises for multiple-choice questions, for contextual meaning -- Reading newspapers, magazine articles for critical comments.

UNIT IV WRITING SKILL **9**

Writing emails, messages, notices, agendas, leaflets, brochures, instructions, recommendations, functional checklists, minutes of a meeting -- Writing paragraphs, comparing, contrasting, presentations with an Introduction, Body and Conclusion -- Arranging appointments, asking for permission, apologizing and offering compensation - Writing formal business letters -- Letter inviting, accepting, declining the invitation -- Letter to the editor -- Requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letter applying for a job, enclosing a CV or Resume -- Writing short reports -- Industrial accident reports -- Writing short proposals.

UNIT V THINKING SKILL **9**

Developing the acquisition and imparting the knowledge of English using thinking skills -- Eliciting thinking blocks for critical interpretation -- Decoding diagrammatic and pictorial representations into English orthographic version in the form of words, phrases, expressions, idioms, sayings and proverbs.

Total : 45

REFERENCE

1. Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - BEC Preliminary. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).
2. Devaki Reddy &ShreeshChaudhary. Technical English. New Delhi: Macmillan, 2009.
3. Rutherford, Andrea J. Basic Communication Skills for Technology. 2nd edition. New Delhi: Pearson Education, 2010.

MA2101 ENGINEERING MATHEMATICS - I

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

OBJECTIVES

The course should enable the students to:

- Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation.
- Understand the Evolutes and Envelope of the curve.
- Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation.
- Learn partial differentiations involving two and three variables and expansions of functions using Taylor series.
- Learn the expansions of trigonometric, hyperbolic functions and their relations.

OUTCOME

The students should be able to:

- Identify Eigen value problems from practical areas and obtain its solutions and using transformation diagonalising the matrix which would render Eigen values.
- Find out effectively the geometrical aspects of curvature and appreciates mathematical skills in constructing evolutes and envelopes in mechanics and engineering drawing.
- Recognize and to model mathematically and solving, the differential equations arising in science and engineering.
- Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation.
- Acquire skills in using trigonometric and hyperbolic and inverse hyperbolic functions.

UNIT I MATRICES **12**

Review: Basic concepts of matrices-addition, subtraction, multiplication of matrices - adjoint -inverse - solving cubic equations.

Characteristic equation - Properties of Eigen values - Eigen values and Eigen vectors -Cayley Hamilton theorem (without proof) - Verification and inverse using Cayley Hamilton theorem.Diagonalisation of matrices - Orthogonal matrices- Quadratic form - Reduction of symmetric matrices to a Canonical form using orthogonal transformation - Nature of quadratic form.

UNIT II DIFFERENTIAL CALCULUS **12**

Review: Basic concepts of differentiation - function of function, product and quotient rules.

UNIT III ORDINARY DIFFERENTIAL EQUATIONS **12**

Review: Definition, formation and solutions of differential equations.

Second order differential equations with constant coefficients - Particular integrals - , eaxCosbx, eaxSinbx. Euler's homogeneous linear differential equations - Legendre's linear differential equation - Variation of parameters.

UNIT IV PARTIAL DIFFERENTIATION **12**

Partial differentiation - differentiation involving two and three variables - Total differentiation -Simple problems. Jacobian - verification of properties of Jacobians - Simple problems. Taylor's series - Maxima and minima of functions of two and three variables.

UNIT V TRIGONOMETRY **12**

Review: Basic results in trigonometry and complex numbers - De Moivre's theorem.Expansions of sinn, cosn, tann where n is apositive integer. Expansions of interms of sines and cosines of multiples of where m and n are positive integers.Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems.

Note: Questions need not be asked from review part.

TOTAL : 60

TEXT BOOKS

1. Erwin Kreyzig, A Text book of Engineering Mathematics, John Wiley, 1999.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
3. Chandrasekaran A, A Text book of Engineering Mathematics I, Dhanam Publications, Chennai, 2010.

REFERENCES

1. Venkataraman M.K, Engineering Mathematics, Volume I, The National Publishing Company, Chennai, 1985.
2. Kandaswamy P, Thilagavathy K and Gunavath K, Engineering Mathematics, Volume I & II, S.Chand and Company, New Delhi, 2005.
3. Bali N.P, Narayana Iyengar. N.Ch., Engineering Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 2003.
4. Veerarajan T, Engineering Mathematics (for first year), Fourth Edition,Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.

PH 2001 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

GOAL

To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES

The course should enable the students to :

- Develop strong fundamentals of properties and behavior of the materials
- Enhance theoretical and modern technological aspects in acoustics and ultrasonics.
- Enable the students to correlate the theoretical principles with application oriented study of optics.
- Provide a strong foundation in the understanding of solids and materials testing.
- Enrich the knowledge of students in modern engineering materials.

OUTCOME

The students should be able to :

- Understand the properties and behaviour of materials.
- Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
- Understand the concept, working and application of lasers and fiber optics.
- Know the fundamentals of crystal physics and non destructive testing methods.
- Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER **9**

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II ACOUSTICS AND ULTRASONICS **9**

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS **9**

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers -

Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING 9

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS 9

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications.

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL : 45

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpat rai publications (P) Ltd., New Delhi 2010.
2. P.Mani, "Engineering Physics ", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata Mc Graw -Hill publishing company Ltd., New Delhi,2003.

REFERENCES:

1. Uma Mukherji, "Engineering Physics ", Narosa publishing house, New Delhi, 2003.
2. Arumugam M., "Engineering Physics ", Anuradha agencies, 2007.
3. Palanisamy P.K., "Engineering Physics ", SciTech Publications, Chennai 2007.
4. Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw -Hill Publications, 2007.
5. P.Charles, Poople and Frank J. Owens, "Introduction to Nanotechnology", Wiley India, 2007.

CY2001 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

GOAL

To impart basic principles of chemistry for engineers.

OBJECTIVES

The course should enable the students to :

- Make the students conversant with the basics of

  (a) Water technology and (b) Polymer science
- Provide knowledge on the requirements and properties of a few important engineering materials.
- Educate the students on the fundamentals of corrosion and its control.
- Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
- Create an awareness among the present generation about the various conventional energy sources.

OUTCOME

The students should be able to :

- Gain basic knowledge in water analysis and suitable water treatment method.
- The study of polymer chemistry will give an idea on the type of polymers to be used in engineering applications.
- Exposure of the students to the common engineering materials will create awareness among the students to search for new materials.
- Knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
- Students with good exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
- A good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY 9

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys - Definition, Examples.

UNIT II ENGINEERING MATERIALS **9**

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.- Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III ELECTROCHEMISTRY AND CORROSION **9**

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series -Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) - Constituents of Paints and varnish.

UNIT IV CHEMICAL THERMODYNAMICS **9**

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity - work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics - entropy change - phase transformations and entropy change - problems - Work Function &Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

UNIT V FUELS ANDENERGY SOURCES **9**

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery - Fuel Cells - Hydrogen -Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy - Light water nuclear power plant.

Total : 45

TEXT BOOKS

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand &Company Ltd., New Delhi, 2003
2. Murthy, Agarwal &Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S.Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S.Sumathi and P.S.Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004
3. A. Gowarikar, Text Book of Polymer Science, 2002
4. Kuriacose &Rajaram, Vols. 1 &2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

ME 2101 ENGINEERING GRAPHICS

L	T	P	C
1	0	3	3

GOAL

To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings.

OBJECTIVES

The course should enable the students to:

1. Introduce drawing standards and use of drawing instruments.
2. Introduce first angle projection.
3. Practice of engineering hand sketching and introduce to computer aided drafting
4. Familiarize the students with different type of projections.
5. Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS.

OUTCOME

The students should be able to :

1. Develop Parametric design and the conventions of formal engineering drawing.
2. Produce and interpret 2D & 3D drawings.
3. Communicate a design idea/concept graphically.
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact.

Note: Only first angle projection is to be followed

BASICS OF ENGINEERING GRAPHICS **2**

Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning - Geometrical constructions - Scales. Construction of curves like ellipse, parabola, cycloids and involutes.

UNIT I PROJECTION OF POINTS, LINES AND SURFACES **15**

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projection - Naming views as per BIS - First angle projection. Projection of points. Projection of straight lines located in first quadrant (using rotating line method only). Projection of plane surfaces like polygonal lamina and circular lamina. Drawing views when the surface of the lamina is inclined to one reference plane.

UNIT II PROJECTION OF SOLIDS **10**

Projections of simple solids like prism, pyramid, cylinder and cone - Drawing views when the axis of the solid is inclined to one reference plane.

UNIT III DEVELOPMENT OF SURFACES **10**

Introduction to sectioning of solids. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

UNIT IV ORTHOGRAPHIC PROJECTIONS **10**

Orthographic projections - Conversion of orthographic views from given pictorial views of objects, including dimensioning. Free hand sketching of Orthographic views from Pictorial views.

UNIT V PICTORIAL PROJECTIONS **10**

Isometric projection - Isometric scale - Isometric views of simple solids like prisms, pyramids, cylinders and cones. Introduction to perspective Projections.

COMPUTER AIDED DRAFTING (Demonstration Only) **3**

Introduction to computer aided drafting and dimensioning using appropriate software. 2D drawing commands Zoom, Picture editing commands, Dimensioning, Isometric drawing, Iso-Planes and 3D drafting. Plotting of drawing. Practice includes drawing the projection of lines and solids. Prepare isometric view of simple solids like prisms, pyramids, cylinders and cones.

TOTAL : 60

TEXT BOOKS

1. Jeyapoovan T, "Engineering Drawing and Graphics Using AutoCAD", Vikas Publishing House Pvt. Ltd., New Delhi, 2010.
2. Warren J. Luzadder and Jon. M.Duff, "Fundamentals of Engineering Drawing", Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2003.

REFERENCES

1. Bhatt N.D and Panchal V.M, "Engineering Drawing: Plane and Solid Geometry", Charotar Publishing House, Anand-3001, 2007.
2. Thomas E. French, Charles J.Vierck and Robert J.Foster, "Engineering Drawing and Graphic Technology", McGraw- Hill Book company 13th Edition.1987.
3. Venugopal K., "Engineering Graphics", New Age International (P) Limited, New Delhi, 2008.

CS2101 COMPUTER PROGRAMMING

L	T	P	C
3	0	0	3

GOAL

To introduce computers and programming and to produce an awareness of the power of computational techniques that are currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.

OBJECTIVES

The course should enable the students to:

(i) Learn the major components of a Computer system.

(ii) Learn the problem solving techniques.

(iii) Develop skills in programming using C language.

OUTCOME

The student should be able to:

(i) Understand the interaction between different components of Computer system and number system.

(ii) Revise computational strategies for developing applications.

(iii) Develop applications (Simple to Complex) using C programming language.

UNIT I COMPUTER FUNDAMENTALS **9**

Introduction - Evolution of Computers - Generations of Computer - Classification of Computers - Application of Computers - Components of a Computer System - Hardware - Software - Starting a Computer (Booting) - Number Systems.

UNIT II COMPUTER PROGRMMING AND LANGUAGES **9**

Introduction - Problem-Solving Techniques: Algorithms, Flowchart, Pseudocode - Program Control Structures - Programming Paradigms - Programming languages - Generations of Programming Languages - Language Translators - Features of a Good ProgrammingLanguages.

UNIT III PROGRAMMING WITH C **9**

Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.

UNIT IV FUNCTIONS, ARRAYS AND STRINGS **9**

Functions - Storage Class - Arrays - Working with strings and standard functions.

UNIT V POINTERS, STRUCTURES AND UNION **9**

Pointers - Dynamic Memory allocation - Structure and Union - Files.

TOTAL : 45

TEXT BOOK:

1. ITL Education Solution Limited, Ashok Kamthane, "Computer Programming", Pearson Education Inc 2007 (Unit: I to V).

REFERNCES:

1. Byron S. Gottfried, "Programming with C", Second Edition, Tata McGraw Hill 2006.
2. Yashvant Kanetkar, "Let us C", Eighth edition, BPP publication 2007.
3. Stephen G.Kochan, "Programming in C - A Complete introduction to the C programming language" , Pearson Education, 2008.
4. T.JeyaPoovan, "Computer Programming Theory and Practice", Vikas Pub, New Delhi.

CS2131 COMPUTER PROGRAMMING LABORATORY

L	T	P	C
0	0	3	2

GOAL

To provide an awareness to develop the programming skills using computer languages.

OBJECTIVES

The course should enable the students to:

(i) Gain knowledge about Microsoft office, Spread Sheet.

(ii) Learn a programming concept in C.

OUTCOME

The student should be able to:

(i) Use MS Word to create document, table, text formatting and Mail merge options.

(ii) Use Excel for small calculations using formula editor, creating different types of charts and including pictures etc,

(iii) Write and execute the C programs for small applications.

LIST OF EXPERIMENTS:

a) Word Processing **12**

1. Document creation, Text manipulation with Scientific notations
2. Table creation, Table formatting and Conversion
3. Mail merge and Letter preparation
4. Drawing - flow Chart

b) Spread Sheet **9**

5. Chart - Line, XY, Bar and Pie
6. Formula - formula editor
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document

c) Programming in C **24**

8. To write a C program to prepare the electricity bill
9. Functions:
   (i) Call by value (ii) Call by reference
10. To write a C program to print the Fibonacci series for the given number
11. To write a C program to find the factorial of number using recursion
12. To write a C program to implement the basic arithmetic operations using Switch Case Statement
13. To write a C program to check whether the given number is an Armstrong number
14. To write a C program to check whether the given string is a Palindrome
15. To write a C program to create students details using Structures
16. To write a C program to demonstrate the Command Line Arguments
17. To write a C program to implement the Random Access in Files
18. To write C programs to solve some of the Engineering applications

TOTAL : 45

HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30 STUDENTS

HARDWARE

LAN system with 33 nodes (OR) Standalone PCs - 33 Nos

Printers - 3 Nos

SOFTWARE

OS - Windows / UNIX

Application package - MS office

Software - C language

GE 2131 - ENGINEERING PRACTICES LABORATORY I
(Common to all Branch)

L	T	P	C
0	0	3	2

GOAL

To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

OBJECTIVES

The course should enable the students to:

1. Relate theory and practice of basic Civil and Mechanical Engineering
2. Learn concepts of welding and machining practice
3. Learn concepts of plumbing and carpentry practice

OUTCOME

The students should be able to:

1. Indentify and use of tools, Types of joints used in welding, carpentry and plumbing operations.
2. Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.
3. Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.

LIST OF EXPERIMENTS

1. Mechanical Engineering **24**

1. Welding

   Arc welding - butt joints, lap joints and T joints.
2. Basic Machining

   Facing, Turning, Threading and Drilling practice.
3. Machine assembly practice

   Study of centrifugal pump
4. Study on

   a. Smithy operations- Production of hexagonal headed bolt.

   b. Foundry operations - mould preparation for gear and step cone pulley.

2. Civil Engineering **21**

1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting.
2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
3. Wood work: Sawing, Planning and making common joints.
4. Study of joints in door panels, wooden furniture.

Total : 45

LIST OF EQUIPMENT AND COMPONENTS

(For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools:

   (a) Rotary Hammer 2 Nos

   (b) Demolition Hammer 2 Nos

(c) Circular Saw 2 Nos

(d) Planer 2 Nos

(e) Hand Drilling Machine 2 Nos

(f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

TEXT BOOK:

1. T. Jeyapoovan, M.Saravanapandian and S. Pranitha, "Engineering Practices Lab Manual", 3rd Edition 2006, Vikas Publishing house (P) Ltd., New Delhi.

EL 2131 COMMUNICATION SKILLS LABORATORY I

L	T	P	C
0	0	3	2

GOAL

The goal of the programme is to provide a practical input towards nurturing accomplished learners who can function effectively in the English language skills.

Objectives

The course should enable the students to :

1. Extend the ability of the learners to be able to listen to English and comprehend its message.
2. Enable the learners to have a functional knowledge of spoken English.
3. Assist the learners to read and grasp the meaning of technical and non-technical passages in English.
4. Help the learners develop threat of writing without mistakes.
5. Expand the thinking capability of the learners so that they would learn how to view things from a different angle.

OUTCOMES

The students should be able to :

1. Listen to and evaluate English without difficulty and comprehend its message.
2. Develop a functional knowledge of spoken English so as to use it in the institution and at job interviews.
3. Read and comprehend the meaning of technical and non-technical passages in English.
4. Develop theart of writing so as to put down their thoughts and feelings in words.
5. Think independently and contribute creative ideas.

UNIT I LISTENING SKILL

Topics: Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV-- Talk shows - News - Educative programmes -- Watching films for critical comments - Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer multiple-choice questions.

UNIT II SPEAKING SKILL

Topics: Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice in dialogues -- Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -- academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

UNIT III READING SKILL

Topics: Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading - - Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures, advertisements, pamphlets for improved presentation.

UNIT IV WRITING SKILL

Topics: At the beginning of the semester, the students will be informed of a mini dissertation of 1000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

UNIT V THINKING SKILL

Topics: Practicein preparing thinking blocks to decodediagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading.

REFERENCE BOOKS

1. Raman, Meenakshi, and Sangeetha Sharma. Technical Communication: English Skills for Engineers. 2nd edition. New Delhi: Oxford University Press, 2010.
2. Riordian, Daniel. Technical Communication. New Delhi. Cengage Learning, 2009

WEBSITES FOR LEARNING ENGLISH

1. **British: Learn English - British Council (Listen & Watch) -** <http://learnenglish. british council.org/>
2. **American: Randall's ESL Cyber Listening Lab -** <http://www.esl-lab.com/>
3. **Intercultural: English Listening Lesson Library Online -** http://www.elllo.org/

EQUIPMENTS REQUIRED

1. Career Lab:1 room
2. 2 Computers as a Server for Labs (with High Configuration)
3. LCD Projectors - 4 Nos
4. Headphones with Mic (i-ball) - 100 Nos
5. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
6. Teacher table, Teacher Chair - 1 + 1
7. Plastic Chairs - 75 Nos

PH 2031 PHYSICS LABORATORY

L	T	P	C
1	0	3	3

OBJECTIVE

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Physics

OUTCOME

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods

S.No.	List of Experiments	Batch 2 (30)			Batch 1 (30)		
		Week	Periods allotted		Week	Periods allotted	
			L	P		L	P
1	Torsional Pendulum - Determination of rigidity modulus of the material of a wire.	1	1	3	2	1	3
2	Non Uniform Bending - Determination of Young's Modulus.	3	1	3	4	1	3
3	Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.	5	1	3	6	1	3
4	Lee's Disc - Determination of thermal conductivity of a bad conductor.	7	1	3	8	1	3
5	Air Wedge - Determination of thickness of a thin wire.	9	1	3	10	1	3
6	Spectrometer - Refractive index of a prism.	11	1	3	12	1	3
7	Semiconductor laser - Determination of wavelength of Laser using Grating.	13	1	3	14	1	3
	TOTAL	**7**	**2**	**1**	**7**	**2**	**1**
							56 Periods

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

1	Torsional Pendulum	(500 gm, wt, 60 cm wire Al-Ni Alloy)	5 nos.
2	Travelling Microscope	(X10)	15 nos.
3	Capillary tube	(length 10cm, dia 0.05mm)	5 nos.
4	Magnifying lens	(X 10)	15 nos.
5	Lee's disc apparatus	(std form)	5 nos.
6	Stop watch	(+/- 1 s)	5 nos.
7	Meter scale	1m length	5 nos.
8	Spectrometer	(main scale 360 deg, ver 30")	5 nos.
9	Grating	(2500 LPI)	5 nos.
10	Laser	(632.8 nm)	5 nos.
11	Semi transparent glass plate Al coating, 65 nm thickness,	50% visibility	5 nos.
12	Equilateral prism	(n = 1.54)	5 nos.
13	Thermometer	+/- 1 deg	8 nos.
14	Screw gauge	(+/- 0.001cm)	12 nos.
15	Vernier caliper	(+/- 0.01 cm)	8 nos.
16	Steam Boiler	1 L	5 nos.
17	Scale	50 cms	5 nos.
18	Cylindrical mass	100 gms	10 sets
19	Slotted wt	300 gms	5 sets
20	Heater	1.5 KW	5 nos.
21	Transformer sodium vapour lamp1 KW	10 nos.	
22	Sodium vapour lamp	700 W	5 nos
23	Burette	50 mL	5 nos
24	Beaker	250 mL	5 nos
25	Spirit level		10 nos

REFERENCE

1. P.Mani, Engineering PhysicsPracticals, Dhanam Publications, 2011.

CY 2031 CHEMISTRY LABORATORY

L	T	P	C
1	0	3	3

OBJECTIVE

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Chemistry.

OUTCOME

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods

S.No.	List of Experiments (Any Five)	Batch 2 (30)			Batch 1 (30)		
		Week	Periods allotted		Week	Periods allotted	
			L	P		L	P
1	Estimation of Commercial soda by acid-base titration	1	1	3	2	1	3
2	Determination of Percentage of nickel in an alloy	3		3	4		3
3	Determination of Temporary, permanent and total hardness of water by EDTA method	5	1	3	6	1	3
4	Determination of Chloride content in a water sample	7		3	8		3
5	Potentiometric Estimation of iron	9	1	3	10	1	3
6	Conductometric Titration of a strong acid with a strong base	11	1	3	12	1	3
7	Conductometric Titration of mixture of acids.	13	1	3	14	1	3
8	Determination of Degree of polymerization of a polymer by Viscometry	15	1	3	16	1	3
	TOTAL		**6**	**24**		**6**	**24**
							60 Periods

List of Glassware and Equipments required for a batch of 30 students

1	Burette	(50 mL)	30 nos.
2	Pipette	(20 mL)	30 nos.
3	Conical Flask	(250 mL)	30 nos.
4	Distilled water bottle	(1 L)	30 nos.
5	Standard flask	(100 mL)	30 nos.
6	Funnel	(small)	30 nos.
7	Glass rod	20 cm length	30 nos.
8	Reagent Bottle	(250 mL)	30 nos.
9	Reagent Bottle	(60 mL)	30 nos.
10	Beaker	(100 mL)	30 nos.
11	Oswald Viscometer	Glass	30 nos.
12	Measuring Cylinder	(25 mL)	30 nos.
13	Digital Conductivity Meter	PICO make	8 nos.
14	Conductivity cell	(K=1)	12 nos.
15	Digital Potentiometer	PICO make	8 nos.
16	Calomel Electrode	Glass	12 nos.
17	Platinum Electrode	Polypropylene	12 nos.
18	Burette Stands	Wooden	30 nos.
19	Pipette stands	Wooden	30 nos.
20	Retard stands	Metal	30 nos.
21	Porcelain Tiles	White	30 nos.
22	Clamps with Boss heads	Metal	30 nos.

REFERENCES

1. J.Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantative Chemical Analysis, 6th Edition, Pearson Education, 2004.
2. C. W. Garland, J. W. Nibler, D. P. Shoemaker, ;"Experiments in Physical Chemistry, 8th ed.," McGraw-Hill, New York, 2009.
3. S. Sumathi, Engineering Chemistry Practicals, Dhanam Publications, 2011.

SEMESTER - II

MA 2201 ENGINEERING MATHEMATICS II

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

OBJECTIVES

The course should enable the students to:

1) Understand the evaluation of the double and triple integrals in Cartesian and polar forms.
2) Know the basics of Vector calculus.
3) Know Cauchy - Riemann equations, Milne - Thomson method and Conformal mapping
4) Grasp the concept of Cauchy's integral formula, Cauchy's residue theorem and contour integration.
5) Know Laplace transform and inverse Laplace transform and their properties.

OUTCOME

The students should be able to:

1) Find area as double integrals and volume as triple integrals in engineering applications.
2) Evaluatethe gradient, divergence, curl, line, surface and volume integrals along with the verification of classical theorems involving them.
3) Applies analytic functions and their interesting properties inscience and engineering.
4) Evaluate the basics of complex integration and the concept of contour integration which is important for evaluation of certain integrals encountered in practice.
5) Have a sound knowledge of Laplace transform and its properties and their applications in solving initial and boundary value problems.

UNIT I MULTIPLE INTEGRALS **12**

Review: Basic concepts of integration- Standard results - Substitution methods - Integration by parts - Simple problems.

Double integrals: Cartesian and polar co-ordinates -Change of variables - simple problems - Area as a double integral. Triple integrals: Cartesian co ordinates - Volume as a triple integral- simple problems.

UNIT II VECTOR CALCULUS **12**

Review: Definition - vector, scalar - basic concepts of vector algebra - dot and cross products-properties.

Gradient, Divergence and Curl -Unit normal vector, Directional derivative - angle between surfaces-Irrotational and solenoidal vector fields.Verification and evaluation of Green's theorem- Gauss divergence theorem and Stoke's theorem.Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS **12**

Review: Basic results in complex numbers - Cartesian and polar forms - Demoivre's theorem.

Functions of a complex variable - Analytic function - Necessary and sufficient conditions (without proof) - Cauchy - Riemann equations - Properties of analytic function - Harmonic function - Harmonic conjugate - Construction of Analytic functions by Milne - Thomson method.Conformal mapping: w = z + a, az, 1/z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION **12**

Statement and application of Cauchy's integral theorem and Integral formula- Evaluation of integrals using the above theorems -Taylor and Laurent series expansions-Singularities - Classification. Residues - Cauchy's residue theorem (without proof)- Contour integration over unit circle and semicircular contours (excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM **12**

Laplace transform - Conditions of existence - Transform of elementary functions - properties- Transforms of derivatives and integrals - Derivatives and integrals of transforms - Initial and final value theorems - Transforms of unit step function and impulse function - Transform of periodic functions. Inverse Laplace transform - Convolution theorem - Solution of linear ODE of second order with constant coefficients.

TOTAL : 60

Note: Questions need not be asked from review part.

TEXT BOOKS

1. VenkatramanM.K, Mathematics, Volume II, National Publishing Company, Chennai, 1985.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
3. Chandrasekaran A, Engineering Mathematics, Volume - II, Dhanam Publication, 2008.

REFERENCES

1. Kandasamy P, Engineering Mathematics Volume II, S. Chand & Co., New Delhi, 1987.
2. Grewal B.S, "Engineering Maths - II", Sultan Chand, New Delhi, 1993.
3. Bali N.P, Manish Goyal, Text book of Engineering Mathematics, 3rd Edition, Lakshmi Publications, 2003.

PH2001 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

GOAL

To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES

The course should enable the students to :

1) Develop strong fundamentals of properties and behavior of the materials
2) Enhance theoretical and modern technological aspects in acoustics and ultrasonics.
3) Enable the students to correlate the theoretical principles with application oriented study of optics.
4) Provide a strong foundation in the understanding of solids and materials testing.
5) Enrich the knowledge of students in modern engineering materials.

OUTCOME

The students should be able to :

1) Understand the properties and behavior of materials.
2) Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
3) Understand the concept, working and application of lasers and fiber optics.
4) Know the fundamentals of crystal physics and non destructive testing methods.
5) Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER 9

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS **9**

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING **9**

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS **9**

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications.

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL : 45

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpat rai publications (P) Ltd., New Delhi 2010.
2. P.Mani, "Engineering Physics ", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata Mc Graw -Hill publishing company Ltd., New Delhi,2003.

REFERENCES:

1. Uma Mukherji, "Engineering Physics", Narosa publishing house, New Delhi, 2003.
2. Arumugam M., "Engineering Physics", Anuradha agencies, 2007.
3. Palanisamy P.K., "Engineering Physics ", SciTech Publications, Chennai 2007.
4. Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw -Hill Publications, 2007.
5. P.Charles, Poople and Frank J. Owens, "Introduction to Nanotechnology", Wiley India, 2007.

CY2001 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

GOAL

To impart basic principles of chemistry for engineers.

OBJECTIVES

The course should enable the students to :

1) Make the students conversant with the basics of

   (a) Water technology and (b) Polymer science

2) Provide knowledge on the requirements and properties of a few important engineering materials.

3) Educate the students on the fundamentals of corrosion and its control.

4) Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.

5) Create an awareness among the present generation about the various conventional energy sources.

OUTCOME

The students should be able to :

1) Gain basic knowledge in water analysis and suitable water treatment method.

2) The study of polymer chemistry will give an idea on the type of polymers to be used in engineering applications.

3) Exposure of the students to the common engineering materials will create awareness among the students to search for new materials.

4) Knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.

5) Students with good exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.

6) A good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY 9

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys - Definition, Examples.

UNIT II ENGINEERING MATERIALS **9**

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.- Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III ELECTROCHEMISTRY AND CORROSION **9**

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series -Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) - Constituents of Paints and varnish.

UNIT IV CHEMICAL THERMODYNAMICS **9**

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity - work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics - entropy change - phase transformations and entropy change - problems - Work Function &Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

UNIT V FUELS AND ENERGY SOURCES **9**

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery - Fuel Cells - Hydrogen -Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy - Light water nuclear power plant.

Total = 45

TEXT BOOKS

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand &Company Ltd., New Delhi, 2003
2. Murthy, Agarwal &Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S.Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S.Sumathi and P.S.Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004
3. A. Gowarikar, Text Book of Polymer Science, 2002
4. Kuriacose &Rajaram, Vols. 1 &2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

AE 2201 SOLID MECHANICS

L	T	P	C
3	1	0	4

GOAL

Understanding effects of loads on structures --- loads could be tension, compression, bending, twisting --- arriving at the stresses & strains and establish factors of safety.

OBJECTIVES

The course should enable the students to learn :

1) Stress and Strain - Hooke's Law - Elastic constants and their relationship- Statically determinate cases - bar with uniform and varying section statically indeterminate cases -composite bar. Thermal Stresses - stresses due to freely falling weight.

2) Shear force and bending moment diagrams for simply supported and cantilever beams - Bending stresses in straight beams - Shear Stresses in bending of beams with various cross sections - beams of uniform strength

3) Beam Deflections through various methods

4) Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts - closely coiled helical springs.

5) Stresses in thin circular cylinder and spherical shell under internal pressure, volumetric Strain. Combined loading, Principal and maximum Shear Stresses - Analytical and Graphical methods.

OUTCOME

The students should be able to understand :

1) Proportional Limit, Elastic Limit, Elastic Constants and relations. Determinacy and indeterminacy. Elongation of bars with uniform varying section. Elongation of compound bars and thermal stresses.

2) Calculation of reaction forces. Differentiate between cantilever and simple support beams. Draw the shear force and bending moment diagrams for various load cases. Establish the relation between Moment, Moment of Inertia, Radius of curvature, Young's modulus. Understand shear stresses and obtain shear stress for various cross sections.

3) Double integration method - McCauley's method - Area moment method - Conjugate beam method.

4) Distinguish difference between bending moment & twisting moment and effects of twisting moment. Find out shear stresses for solid & hollow shafts and study of helical springs.

5) Understand Hoops stress, Meridonal stress for thin cylinders and obtain pressure for spherical shell. Calulate principal planes and find principal stresses. Represent as Mohr's circles in graphical form.

UNIT I BASICS AND AXIAL LOADING **12**

- Stress and Strain - Hooke's Law - Elastic constants and their relationship- Statically determinate cases - bar with uniform and varying section statically indeterminate cases -composite bar. Thermal Stresses - stresses due to freely falling weight.

UNIT II STRESSES IN BEAMS **12**

- Shear force and bending moment diagrams for simply supported and cantilever beams - Bending stresses in straight beams - Shear Stresses in bending of beams with various cross sections - beams of uniform strength

UNIT III DEFLECTION OF BEAMS **12**

- Double integration method - McCauley's method - Area moment method - Conjugate beam method.

UNIT IV TORSION **12**

- Torsion of circular shafts - shear stresses and twist in solid and hollow circular shafts - closely coiled helical springs.

UNIT V BI AXIAL STRESSES **12**

- Stresses in thin circular cylinder and spherical shell under internal pressure, volumetric Strain. Combined loading, Principal Stresses and maximum Shear Stresses - Analytical and Graphical methods.

Total = 60

TEXT BOOKS

1. Nash William - "Strength of Materials", TMH, 1991
2. Timoshenko.S. and Young D.H. - "Elements of strength materials Vol. I and Vol. II"., T. Van Nostrand Co-Inc Princeton-N.J. 1990.

REFERENCES

1. Dym C.L. and Shames I.H. - "Solid Mechanics", 1990.

AE 2202 ENGINEERING MECHANICS

L	T	P	C
3	1	0	4

OBJECTIVES

The course should enable the students to :

1) The course should enable the student to :
2) Understand the Basics & Statics of particles
3) Study the Equilibrium of rigid bodies and resolution of forces
4) Understand the basics of properties of surfaces & solids
5) Study the Dynamics of particles
6) Study the friction and elements of rigid body dynamics

OUTCOME

The students should be able to :

1) The Vectorial representation of forces, Moment & principle of transmissibility
2) The types of supports & Reactions and Equilibrium of Rigid bodies in two & Three dimensions
3) First moment of area and the Centroid of various shapes & sections
4) The Relative motion particles and Impact of elastic bodies
5) The frictional force & types of friction and Translation and Rotation of Rigid Bodies.

UNIT I BASICS & STATICS OF PARTICLES **12**

Introduction - Units and Dimensions - Laws of Mechanics - Lami's theorem, Parallelogram and triangular Law of forces - Vectors - Vectorial representation of forces and moments - Vector operations: additions, subtraction, dot product, cross product - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES **12**

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions - Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS **12**

Determination of Areas and Volumes - First moment of area and the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, - Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle - Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES **12**

Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS **12**

Frictional force - Laws of Coulomb friction - simple contact friction - Rolling resistance - Belt friction. Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

TOTAL : 60

TEXT BOOK

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics - Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics - Statics and Dynamics", IV Edition - Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics - Statics - A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

CY 2002 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

GOAL

To impart basic knowledge on the significance of environmental science for engineers.

OBJECTIVES

The course should enable the students to :

1) Be aware of the existing natural resources such as forest water resources etc. and to educate them to understand the need for preserving the resources.
2) Educate the students about the functions of various ecosystems and biodiversity.
3) Provide knowledge on the various aspects of different types of pollution such as air pollution, water pollution, soil pollution etc.
4) Give a basic knowledge on the social issues such as global warming, acid rain, ozone layer depletion, nuclear hazards etc. and to educate them about the various Environmental Protection Acts.
5) Create an awareness among the present generation about the various aspects of human population and their effect on environment.

OUTCOME

The students should be able to :

1) The students would have understood the effects of over exploitation of water resources, forest resources etc. and their impact on day to day life on earth.
2) Knowledge on the functions of several of ecosystems will help the students to design the processes that are eco friendly.
3) Knowledge on the different types of pollution will help the young minds to device effective control measures to reduce rate of pollution.
4) Exposure on the issues such as global warming, acid rain, ozone layer depletion, and nuclear hazards will make the students understand the significances of sustainable development and the need to enforce Environmental Acts.
5) Educating on the various aspects of population explosion will create awareness on population control for effective utilization of the resources and the need to explore new alternate energy resources for a healthy environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance - Need for public awareness - Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests 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, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - 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.

Field study of local area to document environmental assets - river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

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 (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to Biodiversity - Definition: genetic, species and ecosystem diversity - Biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots 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.

Field study of common plants, insects, birds

Field study of simple ecosystems - pond, river, and hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition - Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - Soil 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.

Field Study of local polluted site - Urban / Rural / Industrial / Agricultural

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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 - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. - Wasteland reclamation - Consumerism and waste products - Environment Production 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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations - Population explosion - Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV / AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health - Case studies.

TOTAL 45

TEXT BOOKS

1. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co., 1971.
3. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, 1999.
4. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications, 1998.

REFERENCES

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India, 2004.
2. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.

GE 2231 - ENGINEERING PRACTICES LABORATORY II

L	T	P	C
0	0	3	2

GOAL

To provide knowledge of basic engineering concepts.

OBJECTIVES

The course should enable the students to :

(i) Impart knowledge on basic engineering concepts.

OUTCOME

The students should be able to:

(i) To learn how to use Electrical and Electronics tools.

LIST OF EXPERIMENTS

S.No	LIST OF EXPERIMENTS	HOURS
	Electrical Engineering:	
1.	Wiring for a tube light.	6
2.	Wiring for a lamp and fan.	6
3.	Staircase wiring	3
4.	Study of (i) Iron box and (ii) Fan with Regulator Electronics Engineering	6

5.	Study of Electronic components and Equipments	3
6.	Characteristics of PN junction diode & measurement of Ripple factor of half wave and full wave rectifier.	9
7.	Applications of OP-AMP - Inverter, Adder and Subtractor.	9
8.	Study and verification of Logic Gates	3

TOTAL 45

Components Required:

Electrical Engineering	
Choke	2 nos
Starter	2 nos
Tubelight stand	2 nos
36W tubelight	2 nos
Fan	2nos
40W lamp	5nos
Single way switch	10 nos
Two way switch	5 nos
Iron box	2nos
Fan with regulator opened	1no (demo purpose)
Wires	

Electronics Engineering

IC Trainer Kit, Resistors, Capacitors, CRO, Function Generator,BreadBoard,Regulated Power Supply, Zener Diode, PN Junction Diode, Potentiometer, Digital Multimeter,Ammeter, Voltmeter, Wattmeter, IC 7408,IC 7432,IC 7486, IC 7400, IC 7404, IC 7402

TEXT BOOK

1. T. Jeyapoovan, M.Saravanapandian and S. Pranitha, Engineering Practices Lab Manual, 3rd Edition 2006, Vikas Publishing house (P) Ltd., New Delhi.

EL2231 COMMUNICATION SKILLS LABORATORY II

L	T	P	C
2	0	2	3

GOAL

The goal of the programme is to provide an advanced practical input towards moulding student-achievers who can use the English language with ease.

OBJECTIVES

The course should enable the students to :

1. Extend the power of the learners to listen to English at an advanced level and comment on it.
2. Guide the learners to speak English at the formal and informal levels.
3. Enable learners to read and grasp the in-depth meaning of technical and non-technical passages in English.
4. Help the learners develop the art of writing at the formal and informal levels.
5. Expand the thinking capability of the learners so that they would learn how to be original in their thoughts.

OUTCOME

The students should be able to :

1. Listen to and understand English at an advanced level and interpret its meaning.
2. Develop English at the formal and informal levels and thus gained the confidence to use it without fear.
3. Read and grasp the in-depth meaning of technical and non-technical passages in English.
4. Develop the art of formal and informal writing.
5. Think independently and creatively and also verbalize their thoughts fearlessly.

UNIT I LISTENING SKILL **12**

Topics: Listening to telephonic conversations -- Listening to native British speakers -- Listening to native American speakers - Listening to intercultural communication -- Listening to answer questions as one-liners and paragraphs -- Listening practice to identify ideas, situations and people -- Listening to group discussions -- Listening to films of short duration.

UNIT II SPEAKING SKILL **12**

Topics: Interview skills - People skills - Job interview - Body language and communication -- How to develop fluency -- Public speaking -- Speaking exercises involving the use of stress and intonation - Speaking on academic topics - Brain storming & discussion - Speaking about case studies on problems and solutions - Extempore speeches - Debating for and against an issue - Mini presentations - Generating talks and discussions based on audiovisual aids.

UNIT III READING SKILL **12**

Topics: Reading exercises for grammatical accuracy and correction of errors --Reading comprehension

exercises with critical and analytical questions based on context - Evaluation of contexts - Reading of memos, letters, notices and minutes for reading editing and proof reading -- Extensive reading of parts of relevant novels after giving the gist of the same.

UNIT IV WRITING SKILL **12**

Topics: At the beginning of the semester, the students will be informed of a mini dissertation of 2000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

UNIT V THINKING SKILL **12**

Topics: Practice in preparing thinking blocks to decode pictorial representations into English words, expressions, idioms and proverbs - Eliciting the knowledge of English using thinking blocks -- Picture rereading -- Finding meaning in the meaningless - Interpreting landscapes, simple modern art and verbal and non-verbal communication.

Total : 60

REFERENCE BOOKS

1. Ibbotson, Mark. Cambridge English for Engineering. New Delhi: Cambridge University Press, 2009.
2. Smith-Worthington Jefferson. Technical Writing for Success. New Delhi. Cengage Learning, 2007.

Websites for learning English

1. **British: Learn English - British Council (Business English) -** <http://learnenglish.britishcouncil.org/>
2. **BBC Learning English (General and Business English) -** <http://www.bbc.co.uk/worldservice/learningenglish/>
3. **Intercultural: English Listening Lesson Library Online** <http://www.elllo.org/>

EQUIPMENTS REQUIRED

1. Career Lab:1 room
2. 2 Computers as a Server for Labs (with High Configuration)
3. LCD Projectors - 4 Nos
4. Headphones with Mic (i-ball) - 100 Nos
5. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
6. Teacher table, Teacher Chair - 1 + 1
7. Plastic Chairs - 75 Nos

AE 2231 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	2

GOAL

To develop the knowledge in testing the materials for hardness, fatigue, impact, tension and torsion.

OBJECTIVE

The course should enable the students to :

1) Test a specimen using Brinell hardness testing machine.
2) Test a specimen using Rockwell hardness testing machine.
3) Perform tension test on mild steel a rod using universal testing machine.
4) Perform torsion test on a mild steel rod using universal testing machine.
5) Perform impact test using Izod impact testing machine.
6) Perform impact test using Charpy impact testing machine.
7) Perform fatigue test in rotating beam using fatigue tester
8) Perform tension and compression test on open and closed helical spring setup.
9) Perform tension and compression test on wood using UTM .
10) Verify Maxwell reciprocal therom

OUTCOME

The students should be able to :

1) The hardness of the material is found out and verified.
2) The hardness of the material is found out and verified.
3) The yield load, ultimate load of the mild steel rod is found out.
4) The ultimate torque of the mild steel rod is found out.
5) The impact load of the material is found out.
6) The impact load of the material is found out.
7) The fatigue load of the rotating beam is found out.
8) The ultimate compressive load and tensile loads are found out.
9) The ultimate compressive load is found out
10) Maxwell reciprocal theorem is verified.

LIST OF EXPERIMENTS

1.	Hardness test - a)Vickers b) Brinell c) Rockwell	9
2.	Tension test	6
3.	Torsion test	6

4.	Impact test - a) Izod b) Charpy c) Drop Test.	6
5.	Fatigue test - a) Reverse plate bending b) Rotating Beam	6
6.	Testing of springs	6
7.	Block Compression Test	6
		Total 45

LIST OF EQUIPMENTS

S.No	Details of Equipments	Qty	Required For Experiments
1	Brinell Hardness Testing Machine	1	1
2	Rockwell Hardness Testing Machine	1	1
3.	Universal Testing Machine	1	2,3,7
4.	Izod Impact Testing Machine	1	4
5.	Charpy Impact Testing Machine	1	4
6.	Fatigue tester- Rotating Beam	1	5
7.	Fatigue tester -Reverse plate bending	1	5

SEMESTER - III

MA2301 ENGINEERING MATHEMATICS III

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in engineering mathematics

OBJECTIVES

The course should enable the students to:

1) Learn techniques of solving the standard types of first and second partial differential equations.
2) Grasp the Fourier series expansions for the given periodic function in the specific intervals and their different forms.
3) Learn solving one dimensional wave equation, One and two dimensional heat equation using Fourier series.
4) Understand the problems using Fourier transform and learns their properties.
5) Understand the problems using Z - transform and learns their properties.

OUTCOME

The students should be able to:

1) Formulate mathematically certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
2) Use the knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
3) Formulate and identify certain boundary and initial value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve the vibration and heat flow problems and then interpret the results.
4) Apply Fourier transform pair, their properties, with the possible special cases with attention to their applications
5) Apply the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order non linear partial differential equations- simple problems - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series - Half range cosine series - Complex form of Fourier Series - Parseval's identity - Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS **12**

Classification of second order quasi linear partial differential equations - Solutions of one dimensional wave equation - One dimensional heat equation - Steady state solution of two-dimensional heat equation (Insulated edges excluded) - Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM **12**

Fourier integral theorem (without proof) - Fourier transform pair - Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - simple problems.

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS **12**

Z-transform - Elementary properties - Inverse Z - transform - Convolution theorem -Formation of difference equations - Solution of difference equations using Z - transform.

TOTAL : 60

TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.
3. Wylie C. Ray and Barrett Louis, C., "Advanced Engineering Mathematics", Sixth Edition, McGraw-Hill, Inc., New York, 1995.

REFERENCES

1. Andrews, L.A., and Shivamoggi B.K.,"Integral Transforms for Engineers and Applied Mathematicians," MacMillan, New York, 1988.
2. Narayanan, S., Manikavasagom Pillai, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
3. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.

AE 2301 ELEMENTS OF AERONAUTICS

L	T	P	C
3	0	0	3

GOAL

To introduce the basic concepts of aerospace engineering and the current developments in the field.

OBJECTIVES

The course should enable the student to :

1. Understand the Historical evaluation of Airplanes
2. Study the different component systems and functions
3. Understand the basic properties and principles behind the flight

4. Study the different structures & construction

5. Study the various types of power plants used in aircrafts

OUTCOME

The student should be able to understand :

1. The history of aircraft & developments over the years

2. The types & classifications of components and control systems

3. The basic concepts of flight & Physical properties of Atmosphere

4. The types of fuselage and constructions and Landing gear systems

5. Different types of Engines and principles of Rocket

UNIT I HISTORICAL EVALUATION **8**

Early airplanes, biplanes and monoplanes, Developments in aerodynamics, materials, Structures and propulsion over the years.

UNIT II AIRCRAFT CONFIGURATIONS **5**

Components of an airplane and their functions. Different types of flight vehicles, classifications.

Conventional control, Powered control, Basic instruments for flying, typical systems for control Actuation.

UNIT III INTRODUCTION TO PRINCIPLES OF FLIGHT **10**

Physical properties and structure of the atmosphere, Temperature, pressure and altitude Relationships, Evolution of lift, drag and moment. Aerofoils, Mach number, Manoeuvres.

UNIT IV INTRODUCTION TO AIRPLANE STRUCTURES **12**

General types of construction, Monocoque, semi-monocoque and geodesic construction, Typical wing and fuselage structure. Landing Gear Structure

UNIT V POWER PLANTS USED IN AIRPLANES **10**

Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust Production. Comparative merits, Principles of operation of rocket, types of rockets and typical Applications, Exploration into space.

Total : 45

TEXT BOOK

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, 1995.

REFERENCE

1. Kermode, A.C., "Flight without Formulae", McGraw-Hill, 1997.

AE 2302 AERO ENGINEERING THERMODYNAMICS

L	T	P	C
3	1	0	4

GOAL

To give a brief background of application of various laws of thermodynamics and its application in heat transfer, refrigeration and air-conditioning, jet propulsion system.

OBJECTIVES

The course should enable the students to :

1. Have a basic idea about Thermodynamic Systems, and processes.
2. Understand the air cycles like (Otto, Diesel, Dual combustion and Brayton combustion cycles) They should understand PV diagrams of four stroke and two stroke IC Engines.
3. Understand the thermodynamics of One Dimensional fluid flow and the application of Continuity and energy equations Properties of steam .To understand the Simple jet propulsion system and Thrust rocket motor
4. Understand about the refrigeration and Principles of Air conditioning and understand the Coefficient of performance and Properties of refrigerants.

OUTCOME

The students should be able to :

1. Understand the basic thermodynamic systems.
2. Understanding about the air cycles, and understanding about the plot of the PV diagrams of four stroke and two stroke IC Engines
3. Understand about the One Dimensional fluid flow and the applications of the Continuity equation and understand about the simple jet propulsion systems.
4. Understand about the Principles of refrigeration and Air conditioning and understand the Coefficient of performance and Properties of refrigerants.

UNIT I BASIC THERMODYNAMICS 12

Systems, Zeroth Law, First Law - Heat and work transfer in flow and non-flow processes, Second law, Kelvin- Planck statement - Clausius statement - concept of entropy - Clausius inequality - entropy change in non-flow processes.

UNIT II AIR CYCLES 12

Otto, Diesel, Dual combustion and Brayton combustion cycles - Air standard efficiency - Mean effective pressure - Actual and theoretical PV diagrams of four stroke and two stroke IC Engines.

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 12

Application of Continuity and energy equations- Properties of steam - Rankine cycle - Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor - Specific impulse.

UNIT IV REFRIGERATION AND AIR CONDITIONING **12**

Principles of refrigeration, Air conditioning - Heat pumps - Vapour compression - Vapour absorption types - Coefficient of performance, Properties of refrigerants.

UNIT V AIR COMPRESSORS **12**

Classification and working principle, work of compression with and without clearance volume, Isothermal and Isentropic efficiency of reciprocating air compressors, multistage compression and intercooling. Various types of compressors (Descriptive treatment only).

Total : 60

TEXT BOOKS

1. Rathakrishnan, E, "Fundamentals of Engineering Thermodynamics", Prentice - Hall, India, 2000
2. Nag. P.K., "Engineering Thermodynamics", Tata McGraw-Hills Co., Ltd., Seventh Edn., 1993
3. Yunus A.Cengal. "Thermodynamics an Engineering Approach", Tata McGraw-Hill Co. Ltd., 3rd Edition, 2002.

REFERENCES

1. Mayhew, A. and Rogers, B., "Engineering Thermodynamics", Longman Green & Co. Ltd., London, E.L.B.S. Edition, 1990.
2. Van Wylen, G.J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics (S.I.Version)", Second Edition, 1986.
3. Bacon, D.H., "Engineering Thermodynamics", Butterworth & Co., London, 1989.
4. Saad, M.A., "Thermodynamics for Engineers", Prentice-Hall of India Pvt. Ltd., 1989.
5. Reynolds, "Thermodynamics", Int. Student Edn., McGraw-Hill Book Co., Ltd., 1990

AE 2303 FLUID MECHANICS AND MACHINERY

L	T	P	C
3	1	0	4

GOAL

To introduce the behaviour of fluids, kinematics and dynamics of fluids and hydraulic Machines

OBJECTIVES

The course should enable the students to :

1. Understand the principles of Basic concepts and properties of Fluid
2. Understand the Fluid Kinematics and its Dynamics
3. Study the basic concepts of Incompressible Flows
4. Study the basic concepts of Fluid Machines and Hydraulic turbines
5. To study the Hydraulic pumps & its applications

OUTCOME

The students should be able to :

1. The basic terms like Pressure, Density, Surface Tension & Fluid Statics
2. The types of flows, stream functions, Velocity Potential & familiarize in equations of Fluid Motion
3. The Laminar Flows, Flow through Pipes, Boundary Layers
4. The working Principles of Various Turbines like Kaplan, Pelton, Francis
5. The working Principles of Pumps like Centrifugal & Reciprocating Pumps

UNIT I BASIC CONCEPTS AND PROPERTIES 6

Fluid - definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS 12

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms). Equation of streamline - stream function - velocity potential function - circulation - flow net. Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation - applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's pi theorem- applications - similarity laws and models.

UNIT III INCOMPRESSIBLE FLUID FLOW 12

Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -weisback's equation - pipe roughness - friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

UNIT IV HYDRAULIC TURBINES 8

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies - performance curve for turbines.

UNIT V HYDRAULIC PUMPS 7

Pumps: definition and classifications - Centrifugal pump: Classifications, working principles, velocity triangles, specific speed, efficiency and performance curves. Reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps - rotary pumps, working principles of gear and vane pumps.

TOTAL : 45

TEXT BOOK

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
2. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi (7th edition), 1995.
3. Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers, 1992.

REFERENCES

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 1995.
2. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1991.
4. Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2004.

AE 2304 AIRCRAFT MATERIALS

L	T	P	C
3	0	0	3

GOAL

To introduce various materials used in Aerospace industry, their behavior and testing methods

OBJECTIVES

The course should enable the students to :

1. Know about various types of materials and Knowledge of various types of hardness testing machines and various types of hardness numbers Linear and non-linear elastic properties- Stress and Strain Curves.
2. Know about the materials used in aircraft construction- Aluminium, Magnesium and Titanium
3. Know about the materials used in aircraft construction- Steel, Copper alloys and Super alloys.
4. Know about the adhesives and sealants used in aircraft industries.
5. Know about the non metals used in aircraft construction.

OUTCOME

The students should be able to :

1. Understand the different materials used and know the various types of hardness testing machine. Knowledge of Stress-strain curves for different type of materials.
2. Acquire knowledge about the properties of the material, the process of machining them and heat treating them.
3. Acquire knowledge about the specification of materials, their structural applications and properties.

4. Find out the different types of adhesives and sealant used, their advantages and the knowledge of the sandwich and honeycomb structure.

5. Acquire knowledge about the non metals like wood, fabrics, glass, plastics and the use of composite materials.

UNIT I MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS 9

Knowledge of various types of hardness testing machines and various types of hardness numbers Linear and non-linear elastic properties - Stress and Strain Curves - Yielding and strain Hardening ,Toughness - Modules of resilience -- Bauchinger's effect - Effect of notches - Testing and flaw detection of materials and components.

UNIT II MATERIALS IN AIRCRAFT CONSTRUCTION - I 9

Aluminium and its alloys: Types and identification. Properties - Castings - Heat treatment processes - Surface treatments.

Magnesium and its alloys: Cast and Wrought alloys - Aircraft application, features specification, fabrication problems, Special treatments.

Titanium and its alloys: Applications, machining, forming, welding and heat treatment.

UNIT III MATERIALS IN AIRCRAFT CONSTRUCTION - II 9

Steels : Plain and low carbon steels, various low alloy steels, aircraft steel specifications ,corrosion and heat resistant steels, structural applications .

Maraging Steels: Properties and Applications

Copper Alloys - Monel, K Monel

Super Alloys: Use - Nickel base - Cobalt base - Iron base - Forging and Casting of Super alloys - Welding, Heat treatment.

UNIT IV ADHESIVE AND SEALANTS FOR AIRCRAFT 9

Advantages of Bonded structure in airframes - Crack arresting - Weight saving - Technology of adhesive Bonding Structural adhesive materials - Test for bonding structure

Typical bonded joints &non destructive tests for bonded joint

Bonded Sandwich structures - Materials - Methods of construction of honeycombs

UNIT V NON METALS IN AIRCRAFT CONSTRUCTION 9

Wood and fabric in aircraft construction and specifications -Glues Use of glass, plastics and rubber in aircraft, Introduction to glass and carbon composite

TEXT BOOKS

1. Lalith Gupta, "Aircraft General Engineering" Himalaya Book House, Delhi 2003

2. HajiraChowdhry, "Workshop Technology " - Vol 1 & 2 ,Nedia Promoters, Mumbai

REFERENCE

1. "Aircraft Material & Process", Titterton 2004

2. "Advanced Composite Materials", Lalith Gupta 2006, Himalaya Book House, Delhi.

AE 2331 WORKSHOP PRACTICE LAB

L	T	P	C
0	0	3	2

GOAL

To gain hands on experience on working of general purpose machine tools

OBJECTIVES

The course should enable the students to :

1. Have hands on experience in lathe machine for operations like turning, facing etc
2. Have hands on experience in shaping and slotting tools
3. Have hands on experience in Drilling mechanism for 4 to 6 holes and reaming, tapping

OUTCOME

The students should be able to:

1. Carry out exercise on lathe machine
2. Carry out V block and internal keyway design
3. Carry out exercise in Drilling ,reaming and tapping task

1. LATHE **15**

1.1. Facing, plain turning and step turning
1.2. Taper turning using compound rest.
1.3. Taper turning using taper turning attachment
1.4. Single start V thread, cutting and knurling
1.5. Boring and internal thread cutting.

2. SHAPER AND SLOTTER **15**

2.1. Machining a V- block (in a Shaper)
2.2. Machining hexagonal shape (in a Shaper)
2.3. Machining internal key-way (in a slotter)

3. DRILLING **15**

3.1 Drilling 4 or 6 holes at a given pitch circle on a plate
3.2. Drilling, reaming and tapping

Total : 45

LIST OF EQUIPMENTS

1. Centre Lathe with accessories - 15 No.
2. Shaping Machine - 2 No.
3. Slotting Machine - 1 No.
4. Radial Drilling Machine - 1 No.
5. Upright Drilling Machine - 1 No.

AE 2332 FLUID MECHANICS AND MACHINERY LAB

L	T	P	C
0	0	3	2

GOAL

To find the performance of pump like centrifugal pump, reciprocating pump, Gear pump. To find the coefficient of discharge of orifice meter and venturimeter. Conducting the characteristic curves of Kaplan turbine, Francis turbine and Pelton wheel.

OBJECTIVES

The subject should enable the student to:

1. Understand the properties of the fluid and also to learn about the pressure and velocity of the flowing fluid using venturimeter, orifice meter.
2. Understand the discharge of fluid by using pump like centrifugal, reciprocating and gear pump and also to find the rate of flow using rota meter.
3. Understand the efficiency of turbine like Kaplan and francis.
4. Understand the change in pressure (friction factor) of given set of pipes.
5. Understand the efficiency of Pelton wheel.

OUTCOME

The students should be able to:

1. Determine the coefficient of discharge of orifice meter and venturimeter.
2. Conduct experiments and draw the characteristic curves of centrifugal pump, submergible pump, reciprocating pump, Gear pump and also can find the discharge of the pump.
3. Conduct experiments and draw the characteristics curves of Francis turbine and Kaplan turbine and also can find the efficiency of the turbine.
4. Conduct experiments and draw the characteristics curves of Pelton wheel.
5. Determine the friction factor of given set of pipes when there is change in pressure& Calculate the rate of flow using Rotameter.

LIST OF EXPERIMENTS

1.	Calibration of venturimeter	3
2.	Pressure measurement with Pitot static tube	3
3.	Determination of pipe flow losses.	3
4.	Verification of Bernoulli's theorem	3
5.	Flow visualization by Heleshaw apparatus	3
6.	Performance test on centrifugal pumps	6
7.	Performance test on reciprocating pumps	6
8.	Performance test on pelton wheel turbine	6
9.	Performance test on Francis turbine	6
10.	Determination of Viscosity of a Fluid	6
		Total : 45

LIST OF EQUIPMENTS

S.No	Details of Equipments	Qty Req	Experiments No.
1.	Venturimeter setup	1	1,3
2.	Pipe friction set up	1	3
3.	Pitot tube set up	1	2,4
4.	Jet pump	1	6
5.	Submersible pump	1	6
6.	Centrifugal pump	1	6
7.	Reciprocating pump	1	7
8.	Pelton wheel turbine and Francis turbine	1	8,9
9.	Viscosity Meter	1	10
10.	Hele-shaw apparatus	1	5

AE 2333 DESIGN AND DRAFTING LAB

L	T	P	C
0	0	3	2

GOAL

To introduce the concept of design of basic structural components and to draft both manually and using modelling package.

OBJECTIVES

The Subject should enable the student to:

1. Understand the design of riveted joints (Lap joint), learn the advantages and disadvantages.
2. Understand the design of riveted joints (Butt joint); learn the advantages and disadvantages and types of riveted joints.
3. Understand the design of the welded joint.
4. Understand Layout of typical wing structure
5. Understand Layout of typical fuselage structure.
6. Understand the Computer aided modelling of typical aircraft wing.
7. Understand the Computer aided modelling of typical fuselage structure.
8. Understand the Computer aided modelling of landing gear
9. Understand the design of Three view diagram of a typical aircraft
10. Understand the concepts and design of control system.

OUTCOME

The students should be able to:

1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout of typical wing structure.
5. Layout of typical fuselage structure.
6. Computer aided modelling of typical aircraft wing.
7. Computer aided modelling of typical fuselage structure.
8. Computer aided modelling of landing gear
9. Three view diagram of a typical aircraft
10. Layout of control systems

LIST OF EXERCISES

1.	Design of riveted joints (Lap joint)	3
2.	Design of riveted joints (Butt joint with single and double straps).	6
3.	Design of welded joints.	3
4.	Layout of typical wing structure.	6
5.	Layout of typical fuselage structure.	6
6.	Computer aided modelling of typical aircraft wing.	3
7.	Computer aided modelling of typical fuselage structure.	3
8.	Computer aided modelling of landing gear	6
9.	Three view diagram of a typical aircraft	3
10.	Layout of control systems	6
		Total : 45

LIST OF EQUIPMENT

S.No	Equipments	Quantity	Experiments No.
1	Drawing Boards, Drafting machines	30	1 - 5
2	Computer and modeling software	Pentium IV PC's, - 30 Nos. License of Software - 30	6 - 10

AE 2334 THERMODYNAMICS LAB

L	T	P	C
0	0	3	2

GOAL

To make the students understand the basics of Thermodynamics and carry out various experiments on Heat exchanger and stroke engines

OBJECTIVES

The course should enable the students to :

1. Carry out performance test on a 4 stroke engine
2. Carry out valve timing of a 4 stroke engine and Port timing of a 2 stroke engine
3. Carry out test on effectiveness of a parallel flow heat exchanger
4. Carry out test on effectiveness of a counter flow heat exchanger
5. Carry out test for determination of viscosity of a given liquid
6. Carry COP test on a vapour compression refrigeration test rig.
7. Carry COP test on a vapour compression A/C test rig
8. Study about the characteristics of a Gas turbine Engine
9. Carry out experiment on evaluation of conductive Heat transfer coefficient
10. Carry out experiment on evaluation of thermal resistance of composite wall

OUTCOME

The students should be able to :

1. Understand the 4 stroke engine cycle and performance
2. Clearly understand the port timing mechanism and valve timing mechanism of stroke engine
3. Get a clear idea about effectiveness of a parallel flow heat exchanger
4. Get a clear idea about effectiveness of a counter flow heat exchanger
5. Understand the viscosity effects in a given fluid flow
6. Carry COP test on a vapour compression refrigeration test rig
7. Carry COP test on a vapour compression A/C test rig
8. Can clearly understand the performance of a Gas Turbine Engine
9. Evaluate conductive heat transfer co-efficient
10. Understand importance of thermal resistance of composite wall

LIST OF EXPERIMENTS

1.	Performance test on a 4-stroke engine	6
2.	Valve timing of a 4 - stroke engine and port timing of a 2 stroke engine	6
3.	Determination of effectiveness of a parallel flow heat exchanger	6

4.	Determination of effectiveness of a counter flow heat exchanger	6
5.	Determination of the viscosity coefficient of a given liquid	3
6.	COP test on a vapour compression refrigeration test rig	3
7.	COP test on a vapour compression air-conditioning test rig	3
8.	Study of a Gas Turbine Engine.	3
9.	Determination of Conductive Heat Transfer Coefficient.	3
10.	Determination of Thermal Resistance of a Composite wall.	6

Total : 45

LIST OF EQUIPMENTS

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke kirloskar diesel engine and cut section model of 2 stroke petrol engine	1	2
3.	Parallel and counter flow heat exchanger test rig	1	3,4
4.	Red wood viscometer	1	5
5.	Vapour compression refrigeration test rig	1	6

SEMESTER - IV

MA2401 NUMERICAL METHODS

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in numerical solutions.

OBJECTIVES

The course should enable the students to:

1) Learn the techniques of solving the algebraic and transcendental equations.
2) Learn to interpolate using Newton's forward and backward difference formulae for equal and unequal intervals
3) Understand the use of numerical differentiation and understands to find the approximate area using numerical integration.
4) Understand solving numerically the initial value problems for ordinary differential equations using single step and multi step method.
5) Learn the methods of solving second order partial differential equations numerically and use it to solve initial and boundary value problems for partial differential equations.

OUTCOME

The students should be able to:

1) Find out the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations by direct and indirect methods.
2) Solve problems where huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
3) Use the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
4) Solve engineering problems which are characterized in the form of nonlinear ordinary differential equations, since many physical laws are couched in terms of rate of change of oneindependent variable
5) Solve the initial and boundary value problems related heat flow, both one and two dimensional and vibration problems. Understands the numerical techniques of solving the partial differential equation in engineering applications.

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 12

Linear interpolation methods (method of false position) - Newton's method - Statement of Fixed Point Theorem - Fixed point iteration: x=g(x) method. Solution of linear algebraic system of equations - Direct methods - Gauss-Jordon method and Crout's method - Iterative method: Gauss-Seidel method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation - equal intervals - Newton's forward and backward difference formulae - problems. Interpolation-unequal intervals - Newton's divided difference formula - Lagrange's and inverse interpolation-problems.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical differentiation - Newton's forward and backward difference - Divided differences and finite differences - Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules. Two and Three point Gaussian quadrature formulae - Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods: Taylor series method - first order-second order and simultaneous - Euler and Modified Euler methods. Fourth orderRunge - Kutta method for solving first and second order equations - Multi-step methods: Milne's and Adam's predictor and corrector methods.

UNIT V INITIAL AND BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution of second order ordinary differential equation - classification of partial differential equations - Finite difference solution of two dimensional heat flow equations Laplace and Poisson equations. One dimensional heat equation by explicit and implicit methods - One dimensional wave equation

TOTAL : 60

TEXT BOOKS

1. Kandasamy P, Thilagavathy K, Gunavathy K, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.
2. Chandrasekaran A. and Beena James, "Numerical Methods", Dhanam publications, Chennai, 2011.

REFERENCES

1. Burden R.L, and Faires T.D, "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Gerald C.F, Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
3. Balagurusamy E, "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

AE 2401 AIRCRAFT SYSTEMS AND INSTRUMENTS

L	T	P	C
3	0	0	3

GOAL

To make the student to understand the principle and working of aircraft systems and Instruments.

OBJECTIVES

The course should enable the students to :

1. Know the various types of Airplanes control systems, its components & its applications.
2. Know the working principle of Autopilot system, ILS & communication system.
3. Understand the purpose of hydraulic system & its component requirement in a modern aircraft.
4. Study of piston and gas turbine engine system and the various components of engines, its material requirements.
5. Know the various auxiliary system used in the modern Jet aircraft & its purpose.
6. Study the various instruments used in a modern aircraft and its purpose.

OUTCOME

The students should be able to :

1. Understand the working principle of modern control system & its advantages.
2. Describe the working principle of communication & navigation system.
3. Draw a schematic diagram of a hydraulic system for a modern aircraft and explain its function in detail.
4. Describe the various systems of piston & gas turbine engines and the purpose of each system.
5. Describe the working principle of air-conditioning system & Fire protection system.
6. Understand the working principle of aircraft instruments and engine instruments in detail.

UNIT I AIRPLANE CONTROL SYSTEMS 10

Conventional Systems - Power assisted and fully powered flight controls - Power actuated systems - Engine control systems - Push pull rod system, flexible push pull rod system - Components - Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology, Communication and Navigation systems Instrument landing systems, VOR - CCV case studies.

UNIT II AIRCRAFT SYSTEMS 10

Hydraulic systems - Study of typical workable system - components - Hydraulic system controllers - Modes of operation - Pneumatic systems - Advantages - Working principles - Typical Air pressure system - Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification - Shock absorbers - Retractive mechanism.

UNIT III ENGINE SYSTEMS 8

Fuel systems for Piston and jet engines, - Components of multi engines. lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines.

UNIT IV AUXILLIARY SYSTEM **8**

Basic Air cycle systems - Vapour Cycle systems, Boost-Strap air cycle system - Evaporative vapour cycle systems - Evaporative air cycle systems - Oxygen systems - Fire protection systems, De-icing and anti icing systems.

UNIT V AIRCRAFT INSTRUMENTS **9**

Flight Instruments and Navigation Instruments - Gyroscope - Accelerometers, Air speed Indicators - TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of engine instruments - Tachometers - Temperature gauges - Pressure gauges - Operation and Principles.

TOTAL : 45

TEXT BOOKS

1. McKinley, J.L., and Bent, R.D., "Aircraft Maintenance & Repair", McGraw-Hill, 1993.
2. "General Hand Books of Airframe and Powerplant Mechanics", U.S. Dept. of Transportation, Federal Aviation Administation, The English Book Store, New Delhi1995.

REFERENCES

1. Mekinley, J.L. and Bent, R.D., "Aircraft Power Plants", McGraw-Hill, 1993.
2. Pallet, E.H.J., "Aircraft Instruments & Principles", Pitman & Co., 1993.
3. Treager, S., "Gas Turbine Technology", McGraw-Hill, 1997.

AE 2402 MECHANICS OF MACHINES

L	T	P	C
3	1	0	4

GOAL

To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working.

OBJECTIVE

The subject should enable the student to:

1. The Kinematic analysis of simple mechanisms and its velocity and accelerations.
2. Know the various belt and rope drives and friction in screw and nut.
3. Know the Gear and cam profile and geometry.
4. Study the Static and dynamic balancing of the various masses
5. Study the vibrations of single degree of freedom systems and Vibration isolation and absorption

OUTCOME

The students should be able to :

1. Understand the various mechanisms and its degree of freedom
2. Learn to find out the effect of centrifugal and initial tension in both drives and Condition for maximum power transmission.

3. Learn to determine the speed and torque of the various types of gear geometry and also the follower motions of cam profile.

4. Understand the concept of balancing in rotating mass and Balancing of radial V engine (reciprocating mass).

5. Understand the Free, forced and damped vibrations and its force transmitted to supports

UNIT I MECHANISMS **12**

Machine Structure - Kinematic link, pair and chain - Grueblers criteria - Constrained motion - Degrees of freedom - Slider crank and crank rocker mechanisms - Inversions - Applications - Kinematic analysis of simple mechanisms - Determination of velocity and acceleration.

UNIT II FRICTION **12**

Friction in screw and nut - Pivot and collar - Thrust bearing - Plate and disc clutches - Belt (flat and V) and rope drives. Ratio of tensions - Effect of centrifugal and initial tension - Condition for maximum power transmission - Open and crossed belt drive.

UNIT III GEARING AND CAMS **12**

Gear profile and geometry - Nomenclature of spur and helical gears - Gear trains: Simple, compound gear trains and epicylic gear trains - Determination of speed and torque - Cams - Types of cams - Design of profiles - Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT IV BALANCING **12**

Static and dynamic balancing - Single and several masses in different planes -Balancing of reciprocating masses- primary balancing and concepts of secondary balancing - Single and multi cylinder engines (Inline) - Balancing of radial V engine - direct and reverse crank method

UNIT V VIBRATION **12**

Free, forced and damped vibrations of single degree of freedom systems - Force transmitted to supports - Vibration isolation - Vibration absorption - Torsional vibration of shaft - Single and multi rotor systems - Geared shafts - Critical speed of shaft.

TOTAL : 60

TEXT BOOKS

1. Rattan.S.S, "Theory of Machines", Tata McGraw-Hill Publishing Co, New Delhi, 2004.

2. Ballaney.P.L, "Theory of Machines", Khanna Publishers, New Delhi, 2002.

REFERENCES

1. Rao, J.S and Dukkipati, R.V, "Mechanism and Machine Theory", Second Edition, Wiley Eastern Ltd., 1992.

2. Malhotra, D.R and Gupta, H.C., "The Theory of Machines", SatyaPrakasam, Tech. India Publications, 1989.

3. Gosh, A. and Mallick, A.K., "Theory of Machines and Mechanisms", Affiliated East West Press, 1989.

4. Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", McGraw-Hill, 1980.

5. Burton Paul, "Kinematics and Dynamic of Planer Machinery", Prentice Hall

AE 2403 AIRCRAFT STRUCTURES - I

L	T	P	C
3	1	0	4

GOAL

Analysis and design simple a/c structural components

OBJECTIVES

The course should enable the students to :

1. Understand various structural elements
2. Understand statically determinate and indeterminate structural analysis.
3. Understand various energy method
4. Able to understand columns with various end condition.
5. Understand various failure theories.

OUTCOME

The students should be able to:

1. Analysis structural elements in aircraft.
2. Solve three moment equation and moment distribution.
3. To make simplified analysis of a/c structures & apply energy methods.
4. Understand and solve the column problems.
5. Apply failure theories for various loading conditions.

UNIT I STATICALLY DETERMINATE STRUCTURES **12**

Analysis of plane truss - Method of joints - 3 D Truss - Plane frames

UNIT II STATICALLY INDETERMINATE STRUCTURES **12**

Composite beam - Clapeyron's Three Moment Equation - Moment Distribution Method.

UNIT III ENERGY METHODS **12**

Strain Energy due to axial, bending and Torsional loads - Castigliano's theorem - Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.

UNIT IV COLUMNS **12**

Columns with various end conditions - Euler's Column curve - Rankine's formula - Column with initial curvature - Eccentric loading - South well plot - Beam column.

UNIT V FAILURE THEORY **12**

Maximum Stress theory - Maximum Strain Theory - Maximum Shear Stress Theory - Distortion Theory - Maximum Strain energy theory - Application to aircraft Structural problems.

TOTAL : 60

TEXT BOOK

1. Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", McGraw-Hill, 1993.

REFERENCE

1. Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Von Nostrand Co, 1990.

AE 2404 AERODYNAMICS - I

L	T	P	C
3	1	0	4

GOAL

To study aerodynamic concepts and understanding motion of air around an object enables the calculation of forces and moments acting on the object.

OBJECTIVES

The course should enable the students to :

1) Understand the fluid mechanics concepts for advanced applications
2) Study two dimensional flows in aerodynamics
3) Integrate the mathematics with aerodynamics
4) Study ideal flows over wings
5) Study real time viscous flows

OUTCOME

The students should be able to :

1) Should be able to apply fluid mechanics concepts.
2) Should be able to model flow over wing.
3) Should be able to differentiate between ideal and real flows
4) Develops mathematical modelling ability.
5) Understand the real time viscous flow and Boundary Layer behaviour.

UNIT I REVIEW OF BASIC FLUID MECHANICS **6**

Continuity, momentum and energy equations.

UNIT II TWO DIMENSIONAL FLOWS **14**

Basic flows - Source, Sink, Free and Forced vortex, uniform parallel flow. Their combinations,Pressure and velocity distributions on bodies with and without circulation in ideal and real fluidflows. KuttaJoukowski's theorem.

UNIT III CONFORMAL TRANSFORMATION **12**

Joukowski transformation and its application to fluid flow problems, Kutta condition, Blasius theorem.

UNIT IV AIRFOIL AND WING THEORY **14**

Joukowski, Karman - Trefftz, Profiles - Thin aerofoil theory and its applications. Vortex line, Horse shoe vortex, Biot and Savart law, Lifting line theory and its limitations

UNIT V VISCOUS FLOW **14**

Newton's law of viscosity, Boundary Layer, Navier-Stokes equation, displacement, Momentum thickness, Flow over a flat plate, Blasins solution.

TOTAL : 60

TEXT BOOKS

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1985.

REFERENCES

1. Houghton, E.L., and Carruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.
2. Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 1985.
3. Clancey, L.J., "Aerodynamics", Pitman, 1986.

AE 2431 COMPUTER AIDED DRAFTING AND MODELLING LAB

L	T	P	C
0	0	3	2

GOAL

To aid in the design, analysis, and manufacture of products.

OBJECTIVES

The course should enable the students to :

1. Understand the drawing with curves like parabola, spiral, involute
2. Understand the three view of simple solids.
3. Creation of 3D models of simple objects.
4. Understand a simple steel truss.
5. Understand the isometric projection of simple objects.

OUTCOME

The students should be able to :

1. Draw the different curves with B spline or cubic spline method.
2. Draw the front view, side view and top view of solids.
3. Obtaining 2D and multi view drawing of 3D models.
4. Analyze the truss problems using CAD.
5. Plotting the drawings of prism, pyramid, cylinder, and cone.

List of exercises using software capable of drafting and modelling:

1.	Study of capabilities of software for drafting and modelling -Co-ordinate system-Creation of simple figures like polygon and general multi line figures	3
2.	Drawing a title block with necessary text and projection symbols	3
3.	Drawing of curves like parabola, spiral, involute using B spline or cubic spline	3
4.	Drawing of front view and top view of simple solids like prism, pyramid, cylinder,cone.etc	6
5.	Drawing of front view, side view and top view of objects from the given pictorial views	6
6.	Drawing of a plan of residential building	6
7.	Drawing of a simple steel truss	3
8.	Drawing sectional views of prism,pyramid,cylinder,cone.etc,	3
9.	Drawing isometric projection of simple objects	6
10.	Creation of 3D models of simple objects and obtaining 2D and multi view drawing of 3D models	6

Total : 45

Note: Plotting of drawings must be made for each exercise and attached to the records written by students

AE 2432 AIRCRAFT STRUCTURES LABORATORY

L	T	P	C
0	0	3	2

GOAL

The objective of conducting the Aircraft structure laboratory is to make the students understand and appreciate various principle and theorems involved in the theory of aircraft structures, vibrations and experimental stress analyzing the results. This will immensely help the students to enrich their knowledge in the design of various aircraft structural components, namely, wings, fuselage, landing gear, control surfaces, etc.

OBJECTIVES

The course should enable the students to :

1. Determine young's modulus of steel using mechanical extensometers.
2. Determine young's modulus of steel using Electrical extensometers.
3. Find the deflection of beams at various end condition
4. Verify Maxwell's reciprocal theorem and principle of super position
5. Determine Column Testing and South - Well's plot
6. Locate Shear Centre for open and closed section.
7. Determine deflection of Unsymmetical beams
8. Find stresses in circular discs and beams using photoelastic techniques
9. Verify vibrations of beams
10. Wagner beam - Tension field beam

OUTCOME

The students should be able to :

1. Understand the basic concepts of material and science and real experience getting to determine a young's modulus value of Aluminum.
2. Understand the difference of accuracy and precision value from both mechanical and electrical extensometer.
3. Determine the deflection of a simply supported beams and better understand of types of beams and application.
4. Verify the Maxwell's theorem using the supported beam and tested.
5. Determine the buckling load of the column in various section like fixed and hinged and understand about South Well's theorem.
6. Determine the location of Shear Centre
7. Determine the deflection of unsymmetrical beams and better understand of types of beams and application.
8. Determine the stresses in circular discs using photoelastic techniques with various loads
9. Determine various parameters during the vibration of the beams
10. Study about the wagner beam and tension field beam

LIST OF EXPERIMENTS

1.	Determination of Young's modulus of steel using mechanical extensometers.	6
2.	Determination of Young's modulus of aluminum using electrical extensometers	6
3.	Deflection of beams with various end conditions.	3
4.	Verification of Maxwell's Reciprocal theorem & principle of superposition	6
5.	Column - Testing and South - well's plot.	3
6.	Shear centre location for open sections and closed saections	3
7.	Unsymmetrical bending of beams	3
8.	Stresses in circular discs and beams using photoelastic techniques	3
9.	Vibrations of beams	6
10.	Wagner beam - Tension field beam	6

TOTAL : 45

LIST OF EQUIPMENTS

Sl. No.	Equipments	Qty	Experiment No
1.	Mechanical Extensometer	1	1
2.	Electrical strain gauge	10	2
3.	Strain indicator	1	2
4.	Dial Gauges	12	1,2,4,5,6,7
5.	Beam Test set up with various end conditions	2	3
6.	Weight 1 Kg	10	1,2,4,5,6,7
7.	Weight 2 Kg	10	1,2,4,5,6,7
8.	Weight Pans	6	8
9.	Column Test Apparatus	1	5
10.	Beam Test set -up	2	3
11.	Unsymmetrical sections like 'Z' sections	2	7
12.	Channel section and angle section	2	6
13.	Strain indicator and strain gauges	One set	3,9,10
14.	Photo - elastic apparatus	1	8
15.	Amplifier	2	9
16.	Exciter	2	9
17.	Pick - up	2	9
18.	Oscilloscope	2	9
19.	Wagner beam & Hydraulic Jack	1 each	10

AE 2433 AERODYNAMICS LAB

L	T	P	C
0	0	3	2

GOAL

To study experimentally the aerodynamic forces on different bodies at low speeds.

OBJECTIVES

The course should enable the students to :

1. Study performance of subsonic wind tunnel.
2. Study experimentally the pressure distribution of circular, symmetric and unsymmetrical aerofoil
3. Know theForce measurement using wind tunnel balance
4. Study Flow visualization studies in low speed flow over airfoil with different angle of incidence
5. Study performance of supersonic wind tunnel.

OUTCOME

The students should be able to :

1. Measure the velocity of the subsonic wind tunnel at various RPM
2. Pressure distribution of various aerofoils can be identified and lift can be calculated.
3. Coefficient of Lift and drag for symmetric and unsymmetrical aerofoils are analysed.
4. Identify the various flows acting on the aerofoil
5. Study the Supersonic flow and characteristics of it.

To study experimentally the aerodynamic forces on different bodies at low speeds.

LIST OF EXPERIMENTS

1.	Calibration of subsonic wind tunnel.	6
2.	Pressure distribution over smooth and rough cylinder.	3
3.	Pressure distribution over symmetric airfoil.	3
4.	Pressure distribution over cambered airfoil& thin airfoils	3
5.	Force measurement using wind tunnel balance.	6
6.	Flow over a flat plate at different angles of incidence	6
7.	Flow visualization studies in low speed flow over cylinders	3
8.	Flow visualization studies in low speed flow over airfoil with different angle of incidence	3
9.	Calibration of supersonic wind tunnel.	6
10.	Supersonic flow visualization with Schlieren system.	6
		Total : 45

LIST OF EQUIPMENT

Sl.No.	Items	Quantity	Experiment No.
1.	Wind Tunnel test section size around 300 x 300 mm with test section flow speed of 70 m/s.	1 No.	1, 2,3,4,5
2.	Wings of various airfoil sections (Symmetrical & cambered airfoils)	2 Nos. each	3, 4
3.	Angle of incidence changing mechanism	1 No.	3, 4
4.	Multiple Manometer stands with 20 - 30 manometer tubes	4 Nos.	2,3,4
5.	U-Tube Manometer	1 No.	1,2,3,4
6.	Static Pressure Probes	4 Nos.	1,2,3,4
7.	Total Pressure Probest	4 Nos.	1,2,3,4
8.	Pitot-Static Tubes	4 Nos.	1,2,3,4
9.	Wooden Models of Three Dimensional bodies (eg. Cylinder etc.,)	2 Nos. each	2
10.	Wind Tunnel balances (3 or 5 or 6 components)	1 No.	5
11.	Pressure Transducers with digital display	1 No.	1,2,3,4
12.	Hele-Shaw apparatus, Smoke Tunnel, Water flow channel	1 each	6,7,8
13.	Supersonic Wind tunnel of test section size 100 x 100 mm with storage tank capacity of 500ft2 at 20 bar	1 No.	9,10
14.	Wooden models of cone, wedge and blunt body configurations of suitable size for flow visualization in a supersonic wind tunnel test section	1 No.	9,10
15.	Schlieren System	1 No.	9,10

AE 2434 PROJECT WORK

L	T	P	C
0	0	6	2

GOAL

To impart and improve the design capability of the students in Aeronautical Engineering.

OBJECTIVES

To impart and improve the design capability of the students in Aeronautical Engineering

OUTCOME

The student will be able to design new aircrafts, space stations, concept engines and innovative designs related to aeronautical engineering etc.

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks : 20 marks

   (Decided by conducting 3 reviews by the guide appointed by the Institution)

2. Evaluation of Project Report : 30 marks

   (Evaluated by the external examiner appointed by the University).

3. Viva voce examination : 50 marks

   (Evaluated by the internal examiner appointed by the

HOD, external examiner appointed by the University and Guide of the course - with equal Weightage)

The design problem can be allotted to either an individual student or a group of students comprising of not more than six. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

SEMESTER - V

EC2512 MICROPROCESSOR AND APPLICATIONS

L	T	P	C
3	0	0	3

GOAL

To excel in the Architecture of 8086 & 8051 and to develop skill in simple program writing, to study simple applications.

OBJECTIVES

The course should enable the students to :

1) Study The Architecture of 8086 & 8051.
2) Understand The addressing modes & instruction set of 8086 & 8051.
3) Interrupt The need & use of Interrupt structure.
4) Impact knowledge on commonly used peripheral / interfacing ICs.

OUTCOME

The students should be able to :

1) Understand the functional block diagram, Timing Diagram, Interrupt structure and Multiprocessor configurations of 8086 Microprocessors.
2) Develop the Programming skills using Loop structure with counting & Indexing, Look up table, Subroutine instructions stack.
3) Interface ICs 8255 PPI, 8259 PIC, 8257 DMA , 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter, A/D and D/A converter.
4) Comprehend the Functional block diagram ,Instruction format and addressing modes, Interrupt structure,I/O Ports and Serial communication of 8051 Microcontroller.
5) Develop the programming skills in PID control algorithm, square, triangular and sine wave form generation, closed loop control of servo motor and stepper motor control.

UNIT I SEMICONDUCTOR DEVICES 10

Transistors - FET and MOSFET - Silicon Controlled Rectifiers And Triacs - their Applications - Principles and Types of Transistor Amplifiers - RC Coupled, Transformer Coupled, Direct Coupled - Multistage, FET and Power Amplifiers.

UNIT II LINEAR AND DIGITAL ICS 8

IC Technology - Elements of Fabrication of Linear and Digital IC's -Comparison Between Analog and Digital Systems - Number Representation - Binary, Octal and Hexadecimal Number Systems- Half Adder and Full Adder -Multiplexers- Demultiplexers - Decoders - Encoders.

UNIT III MICROPROCESSORS **12**

Architecture of Intel 8085- Instruction Formats - Addressing Modes - Simple Assembly Language Programs - Architecture and Functioning of Intel 8086 Processor - Instruction Formats - Addressing Modes.

UNIT IV INTERFACING AND MEMORY DEVICES **10**

Keyboards and Displays Interfacing - Parallel and Series Communication - Synchronous and Asynchronous Data Transfer - DMA Data Transfer. RAM, ROM, EPROM - Magnetic Bubble Memory - Floppy and Hard Disc.

UNIT V APPLICATIONS **5**

Microprocessor Applications in aerospace - Case study.

TOTAL : 45

TEXT BOOKS

1. "Computer principles of architecture", Tata McGraw-Hill, New Delhi. 4th Edition 2002.
2. Goankar. R.S., "Microprocessors, Programming to Architecture 8085", Penram International publishing PVT Ltd, New Delhi. 5th Edition 2002
3. V.K. Mehta, "Principles of Electronics", S. Chand & Co, New Delhi, 2nd Edition 2002

REFERENCES

1. Malvino A.P. Leach, D.P., "Digital Principles & Applications", Tata McGraw- Hill, 1990.
2. Goankar R.S., "Microprocessors Architecture. Programming and Applications", Wiley Eastern, 1992.
3. Ajit Pal., "Microprocessors", Tata McGraw-Hill, Revised Edition 1995.
4. Douglas, Hall, "Microprocessors and Interfacing", Tata McGraw-Hill, Revised Edition 1990.
5. Mathur A.P., "Introduction to Microprocessors", Tata McGraw-Hill, Revised Edition 1995.

AE 2501 PROPULSION - I

L	T	P	C
3	1	0	4

GOAL

To study in detail about fundamentals of aircraft propulsion, advanced propulsion systems in gas turbine engine. To understand the principles of operation and design of aircraft power plants.

OBJECTIVES

The course should enable the students to :

1. Know the fundamentals of gas turbines and its components
2. Know the design and performance of subsonic and supersonic inlets

3. Know the different types of combustion chambers and factors affecting the combustors.
4. Study the types of nozzles and flow conditions in nozzles.
5. Study the types of compressors and their working principles

OUTCOME

The students should be able to :

1. Understand the working principle of gas turbine engines, thermodynamic cycles and performance characteristics of gas turbine engines.
2. Understand the internal flow and external characteristics near the inlets. Starting problems and different modes of operation in supersonic inlets.
3. Understand the types and working methods in combustion chambers. The flame stabilization and flame techniques.
4. Understand the flow through nozzle, choking, losses in nozzle, variable area nozzle and thrust vector control.
5. Know the types and working principles of compressors, velocity diagrams, blade design and performance characteristics of compressors.

UNIT I FUNDAMENTALS OF GAS TURBINE ENGINES 12

Illustration of working of gas turbine engine - Thrust equation - Factors affecting thrust. Effect of pressure, velocity and temperature changes of air entering compressor. Methods of thrust augmentation. Characteristics of turboprop, turbofan and turbojet - Performance characteristics.

UNIT II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 12

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 external deceleration ratio - Diffuser performance - Supersonic inlets - Starting problem on supersonic inlets - Shock swallowing by area variation - External declaration - Modes of inlet operation.

UNIT III COMBUSTION CHAMBERS 12

Classification of combustion chambers - Important factors affecting combustion chamber design - Combustion process - Combustion chamber performance - Effect of operating variables on performance - Flame tube cooling - Flame stabilization - Use of flame holders.

UNIT IV NOZZLES 11

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 COMPRESSORS 13

Principle of operation of centrifugal compressor - Work done and pressure rise - Velocity diagrams - Diffuser vane design considerations - Concept of prewhirl - Rotation stall - Elementary theory of axial flow compressor - Velocity triangles - degree of reaction - Three dimensional - Air angle distributions for free vortex and constant reaction designs - Compressor blade design - Centrifugal and Axial compressor performance characteristics.

TOTAL : 45

TEXT BOOK

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman, 1919.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1915.
3. "Rolls Royce Jet Engine" - Third Edition - 1913.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.

AE 2502 AERODYNAMICS - II

L	T	P	C
3	1	0	4

GOAL

To understand the behaviour of airflow both internal and external in compressible flow regime with particular emphasis on supersonic flows.

OBJECTIVES

The course should enable the student to :

1. Study the basic equations of one dimensional compressible flow.
2. Study about the normal, oblique shock waves and expansion waves.
3. Study the differential equations of motion for steady compressible flow.
4. Study about the airfoils in high speed flows.
5. Study about the high speed wind tunnels.

OUTCOME

The student should be able to understand :

1. The energy, momentum and continuity equations.
2. The various parameters affecting the normal and oblique shock waves.
3. The various theories regarding the steady compressible flow.
4. The various parameters of airfoil in high speed flow.
5. The various methods for creating supersonic flow in wind tunnels.

UNIT I ONE DIMENSIONAL COMPRESSIBLE FLOW **10**

Energy, Momentum, continuity and state equations. Velocity of sound, Adiabatic steady state flow equations, Flow through converging, diverging passages. Performance under various back pressures.

UNIT II NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES 15

Prandtl equation and Rankine - Hugonoit relation, Normal shock equations, Pitot static tube, corrections for subsonic and supersonic flows, Oblique shocks and corresponding equations. Hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, Rayleigh and Fanno Flow. Flow past convex corners, Expansion hodograph, Reflection and interaction of shocks and expansion waves, Families of shocks, Methods of Characteristics, Two dimensional supersonic nozzle contours.

UNIT III DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS 12

Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert affine transformation relations for subsonic flows, Linearised two dimensional supersonic flow theory, Lift, drag pitching moment and center of pressure of supersonic profiles.

UNIT IV AIRFOIL IN HIGH SPEED FLOWS 12

Lower and upper critical mach numbers, Lift and drag divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects.

UNIT V HIGH SPEED WIND TUNNELS 11

Blow down, indraft and induction tunnel layouts and their design features. Transonic, supersonic and hypersonic tunnels and their peculiarities. Helium and gun tunnels, Shock tubes, Optical methods of flow visualization.

Total : 60

TEXT BOOK

1. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.

REFERENCES

1. Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronold Press, 1912.
2. Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1919.
3. McCornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.
4. Anderson Jr., D., - "Modern compressible flows", McGraw-Hill Book Co., New York 1999.

AE 2503 AIRCRAFT STRUCTURES - II

L	T	P	C
3	1	0	4

GOAL

To study the behaviour of various aircraft structural components under different types of loads.

OBJECTIVES

The course should enable the students to :

1. Understand Unsymmetrical bending
2. Understand shear centre and shear flow
3. Resistance of torque by cells
4. Understand buckling problems
5. Study Tension field beams

OUTCOME

The students should be able to :

1. Analyze for maximum bending stress in unsymmetrical sections
2. Analyze for flexural shear stress
3. Analyze for Torsional shear stress
4. Panel Buckling allowable load
5. Analyze for flange and web load

UNIT I UNSYMMETRICAL BENDING **12**

Bending stresses in beams of unsymmetrical sections - Bending of symmetric sections with Skew loads.

UNIT II SHEAR FLOW IN OPEN SECTIONS **12**

Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of Symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT III SHEAR FLOW IN CLOSED SECTIONS **12**

Bredt - Batho formula, Single and multi cell structures. Approximate methods. Shear flow in single & multi cell structures under torsion. Shear flow in single and multicell under bending with walls effective and ineffective.

UNIT IV BUCKLING OF PLATES **12**

Rectangular sheets under compression, Local buckling stress of thin walled sections, Crippling stresses by Needham's and Gerard's methods. Thin walled column strength. Sheet stiffener panels. Effective width, inter rivet and sheet wrinkling failures.

UNIT V STRESS ANALYSIS IN WING AND FUSELAGE **12**

Shear and bending moment distribution for semi cantilever and other types of wings and Fuselage, thin webbed beam. With parallel and non parallel flanges, Shear resistant web beams, Tension field web beams (Wagner's).

TOTAL : 60

TEXT BOOK

1. Bruhn. E.H. "Analysis and Design of Flight vehicles Structures", Tri - state off set company, USA, 1973.

REFERENCES

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw-Hill, N.Y., 1993.
2. Megson, T.M.G., "Aircraft Structures for Engineering Students", Edward Arnold, 1995.
3. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993.

AE 2531 PROPULSION LAB

L	T	P	C
0	0	3	2

GOAL

To understand concepts of aircraft propulsion and carry out experiments

OBJECTIVES

The course should enable the students to :

1. Study aircraft piston engine, and jet engines
2. Study about forced Convective Heat transfer
3. Study about free Convective heat transfer
4. Perform Cascade testing of a model of axial compressor blade row
5. Determine heat of combustion of aviation fuel
6. Study Combustion performance in a jet engine combustion chamber
7. Study about the free jet
8. Study about the wall jet

OUTCOME

The students should be able to :

1. Gain knowledge about the various systems of aircraft piston engine, jet engines and show the systems on the engines available in the Lab
2. Understand the concept of forced convective heat transfer and perform experiment on the heat transfer apparatus
3. Understand the concept of free convection heat transfer and perform experiment on the heat transfer apparatus
4. Understand the cascade arrangement of a model axial compressor blade row
5. Understand the Heat of combustion of aviation fuel and how to find it using given set up
6. Understand the concept of Combustion performance in a jet engine combustion chamber
7. Understand the concept of free jet
8. Understand the concept of wall jet

LIST OF EXPERIMENTS

1.	Study of an aircraft piston engine and jet engines and its components	6
2.	Study of forced convective heat transfer.	6
3.	Study of free convective heat transfer.	6
4.	Cascade testing of a model of axial compressor blade row	3
5.	Determination of heat of combustion of aviation fuel	6
6.	Combustion performance studies in a jet engine combustion chamber	6
7.	Study of free jet	6
8.	Study of wall jet	6

TOTAL : 45

LIST OF EQUIPMENTS

Sl.No	Equipments	Qty	Experiments No.
1	Piston engines	2	1
2	Jet Engine /Engine model	1	2
3	Forced Convective apparatus	1	3
4	Free Convective apparatus	1	4
5	Bomb calorimeter	1	5
6	Free jet Apparatus	1	7, 8
7	Low speed wind tunnel	1	4

AE 2532 AIRCRAFT STRUCTURAL REPAIR LAB

L	T	P	C
0	0	3	2

GOAL

To give training on riveting, patchwork and welding

OBJECTIVES

The course should enable the students to :

1. Welded patch repair by TIG in Aluminium sheet.
2. Welded patch repair by MIG in mild steel.
3. Riveted patch repairs in Aluminium sheet.
4. Sheet metal forming.
5. Control cable inspection and repair.
6. Repair on Perspex glass panels.
7. Pipe flaring.

OUTCOME

The students should be able to :

1. The TIG welding.
2. The MIG welding.
3. The Riveted patch repair by manual and pneumatic.
4. The forming of different shapes in sheet metal.
5. The repair techniques of control cables
6. The repairing of non metallic window panels of Aircraft
7. The preparation of pipe ends for connecting components.

LIST OF EXPERIMENTS

1.	Sheet Metal Forming.	3
2.	Lap Joint by MIG Welding.	6
3.	Butt Joint by TIG Welding.	6
4.	Lap Joint by Riveting.	3
5.	Butt Joint by Riveting.	3
6.	Surface Patch Repair by Riveting (Using Pneumatic Gun).	3
7.	Control cable inspection and repair.	3
8.	Repair on Perspex glass panels.	6
9.	Pipe flaring.	6
10.	Composite Materials - Fabrication and Repair.	6

Total : 45

LIST OF EQUIPMENT

S.No.	Name of the Equipment	QTY	Experiment No.
1	Shear cutter pedestal type	1	1,4,5,6
2	Drilling Machine	4	4,5,6,8
3	Bench Vices	20	2,3,4,5,6,8
4	Radius Bend bars	1	1
5	Pipe Flaring Tools	5	9
6	MIG Weld Plant	1	2
7	TIG Weld Plant	1	3
8	Pneumatic Riveting Gun	2	6
9	Composite Molding Machine	1	10

SEMESTER - VI

AE 2601 FLIGHT DYNAMICS

L	T	P	C
3	1	0	4

GOAL

To understand the performance of an aircraft in various operating conditions, and static, dynamic response for different disturbances.

OBJECTIVES

The course should enable the students to :

1. Understand drag force acting on an airplane, and variations due to velocity and altitude
2. Understand elements of airplane performance
3. Understand static longitudinal stability of an aircraft
4. Understand lateral and directional stability
5. Understand dynamic stability of an aircraft

OUTCOME

The students should be able to :

1. Know about the forces and moments that are acting on an aircraft, the different types of drag, drag polar, ISA, variation of thrust, power, SFC with velocity and altitude.
2. Have understanding about performance in level flight, minimum drag and power required, climbing, gliding and turning flight, v-n diagram and load factor.
3. Knowledge about degrees of stability, stick fixed and stick free stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing.
4. Understanding about lateral control, rolling and yawing moments, static directional stability, rudder and aileron control requirements and rudder lock.
5. Understanding about dynamic longitudinal stability, stability derivatives, modes and stability criterion, lateral and directional dynamic stability.

UNIT I DRAG ON THE AIRPLANE **12**

International Standard Atmosphere - Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - Drag polars of vehicles from low speed to high speed - Variation of thrust, power and SFC with velocity and altitudes for air breathing engines and rockets - Power available and power required curves.

UNIT II AIRCRAFT PERFORMANCE **15**

Performance of airplane in level flight - Maximum speed in level flight - Conditions for minimum drag and power required - Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate, turn radius). Bank angle and load factor, Limitations of pull up and push over, V-n diagram and load factor.

UNIT III STATIC LONGITUDINAL STABILITY **15**

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes - Static Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric manoeuvres - Stick force gradients - Stick force per 'g' - Aerodynamic balancing. Determination of neutral points and manoeuvre points from flight test.

UNIT IV LATERAL AND DIRECTIONAL STABILITY **8**

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

UNIT V DYNAMIC STABILITY **10**

Dynamic longitudinal stability: Equations of motion - Stability derivatives - Characteristic equation of stick fixed case - Modes and stability criterion - Effect of freeing-the stick - Brief description of lateral and directional. Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

TOTAL : 60

TEXT BOOK

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, New York, 1911.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1912.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1910.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition,
4. Issac Pitman, London, 1911.4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1991

AE 2602 CONTROL ENGINEERING

L	T	P	C
3	1	0	4

GOAL

To understand the basic concepts of flight control system.

OBJECTIVES

The course should enable the students to :

1. Study and solve problems on Simple pneumatic, hydraulic and thermal systems, Mechanical and electrical component analogies.
2. Study and solve problems on Block diagram representation of control systems, Reduction of block diagrams, Signal flow graph.

3. Study and solve problems on Response of systems to different inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.
4. Study and solve problems on Routh - Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.
5. Study about digital control system, Digital Controllers and Digital PID Controllers.

OUTCOME

The students should be able to :

1. The Simple pneumatic, hydraulic and thermal systems, Mechanical and electrical component analogies based problems.
2. The Block diagram representation of control systems, Reduction of block diagrams, Signal flow graph and problems based on it.
3. The Response of systems to different inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit and problems based on it.
4. The Routh - Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response and problems based on it.
5. The digital control system, Digital Controllers and Digital PID Controllers.

UNIT I INTRODUCTION 6

Historical review - Simple pneumatic, hydraulic and thermal systems, Series and parallel systems, Analogies - Mechanical and electrical components, Development of flight control systems.

UNIT II OPEN AND CLOSED LOOP SYSTEMS 6

Feedback control systems - Block diagram representation of control systems, Reduction of block diagrams, Output to input ratios, Signal flow graph.

UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS 10

Laplace transformation, Response of systems to different inputs viz., Step input, impulse, ramp, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT IV CONCEPT OF STABILITY 15

Necessary and sufficient conditions, Routh - Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.

UNIT V SAMPLED DATA SYSTEMS 8

Introduction to digital control system, Digital Controllers and Digital PID Controllers.

TOTAL : 45

TEXT BOOKS

1. OGATO, "Modern Control Engineering", Prentice - Hall of India Pvt. Ltd. New Delhi, 1991.
2. GOPAL.M. "Control Systems, Principles and design" - Tata McGraw-Hill Publication, New Delhi, 2000.

REFERENCES

1. Azzo, J.J.D. and C.H. Houpis, "Feed back control system analysis and synthesis", McGraw - Hill International, 3rd Edition, 1998.
2. Kuo, B.C., "Automatic control systems", Prentice - Hall of India Pvt. Ltd., New Delhi, 1998.
3. Houpis, C.H. and Lamont, G.B., "Digital Control Systems", McGraw-Hill Book Co. New York, USA 1995.
4. Naresh K. Sinha, "Control Systems", New Age International Publishers, New Delhi

AE 2603 EXPERIMENTAL STRESS ANALYSIS

L	T	P	C
3	0	0	3

GOAL

To determines the stress and strain in materials and structures subjected to static or dynamic forces or loads.

OBJECTIVES

The course should enable the students to :

1. Understand instrumentation concepts
2. Understand optics and its application to photo elasticity
3. Understand strain gauges and their applications
4. Understand significance of NDT Methods.
5. Understand the Concept of two dimensional photo elasticity.

OUTCOME

The students should be able to :

1. Analyze instruments for measurements
2. Awareness of NDT methods
3. Use strain gauge effectively
4. Analyze photo elastic results
5. Estimate the Interpretation of fringe pattern

UNIT I MEASUREMENTS **4**

Principles of measurements, Accuracy, Sensitivity and range of measurements.

UNIT II EXTENSOMETERS **6**

Mechanical, Optical, Acoustical and Electrical extensometers and their uses. Advantages and disadvantages.

UNIT III ELECTRICAL RESISTANCE STRAIN GAUGES **10**

Principle of operation and requirements of electrical strain gauges. Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosetteanalysis. Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT IV PHOTOELASTICITY **10**

Two dimensional photo elasticity, Concept of light - photo elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elasticmaterials. Introduction to three dimensional photo elasticity.

UNIT V NON - DESTRUCTIVE TESTING **15**

Fundamentals of NDT. Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittlecoating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph,Fiber - optic Sensors.

TOTAL : 45

TEXT BOOK

1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., "Experimental Stress Analysis", Tata McGraw-Hill, New Delhi, 1914.

REFERENCES

1. Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", McGraw-Hill Inc., New York, 1991.
2. Hetyenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
3. Pollock A.A., "Acoustic Emission in Acoustics and Vibration Progress", Ed. Stephens R.W.B., Chapman and Hall, 1993.

AE 2604 PROPULSION - II

L	T	P	C
3	1	0	4

GOAL

To have introduction of advanced propulsion system

OBJECTIVES

The course should enable the students to :

1. Study about the turbines and its performance for various conditions.
2. Study the basics of ramjet and scramjet with their performance characteristics
3. Study the types of rockets and their working principles

4. Study about chemical rockets and propellants used in chemical rockets.

5. Study the advances in rocket propulsion and space propulsion

OUTCOME

The students should be able to :

1. Understand the working of turbine, blade profiles, performance, cooling methods in turbine blades and its limitations.

2. Understand the operating principle of ramjet, combustion and its performance. Basics of scramjet engine and integral ram engine.

3. Understand the rocket operating principles. Rocket nozzle classifications and performance of rockets.

4. Understand in detail about solid and liquid propellant rockets and the various types of propellants used with their grain structure and their burning rates.

5. Understand about electric, ion and nuclear rockets. The basics of solar sails and its operating principle.

UNIT I AIRCRAFT GAS TURBINES 13

Impulse and reaction blading of gas turbines - Velocity triangles and power output - Elementarytheory - Vortex theory - Choice of blade profile, pitch and chord - Estimation of stage performance- Limiting factors in gas turbine design- Overall turbine performance - Methods of blade cooling -Matching of turbine and compressor - Numerical problems.

UNIT II RAMJET PROPULSION 12

Operating principle - Sub critical, 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 FUNDAMENTALS OF ROCKET PROPULSION 12

Operating principle - Specific impulse of a rocket - Rocket nozzle classification - Rocket performance considerations - Numerical Problems.

UNIT IV CHEMICAL ROCKETS 15

Solid propellant rockets - Selection criteria of solid propellants - Important hardware components of solid rockets - Propellant grain design considerations - Liquid propellant rockets- Selection of liquid propellants - Thrust control in liquid rockets - Cooling in liquid rockets -Limitations of hybrid rockets - Relative advantages of liquid rockets over solid rockets- Numerical Problems.

UNIT V ADVANCED PROPULSION TECHNIQUES 8

Electric rocket propulsion - Ion propulsion techniques - Nuclear rocket - Types - Solar sail- Preliminary Concepts in nozzle less propulsion.

Total : 60

TEXT BOOKS

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5thEdn., 1993.

2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.

REFERENCES

1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "Gas Turbine Theory", Longman Co., ELBS Ed., 1919.
2. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1919.
3. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1911.

AE 2632 AIRCRAFT DESIGN PROJECT

L	T	P	C
0	0	3	2

GOAL

To develop the basic concept of aircraft design by assigning each student a preliminary specification to design an airplane or helicopter or any flight vehicle.

OBJECTIVES

The course should enable the students to :

1. Compare different configuration of airplanes on Specifications and performance details of aircraft.
2. Prepare comparative data sheets.
3. Compare different graph and selection of main parameters for the design.
4. Calculate the preliminary weight estimations, power plant selection, airfoil selection, wing tail and control surfaces.
5. Estimate the drag of the aircraft.

OUTCOME

The students should be able to :

1. See how aircraft design changes from one mission to another.
2. Based upon the mission of the aircraft the students designated for a collection of data are collected from different aircraft having the same mission as selected by the student.
3. Calculate the main design parameter for the aircraft is selected.
4. Give the approximate weight of the aircraft that they design by specifying the different types of weight of the aircraft, the types of power plant selected as well as aerofoil selection and tail empennage.
5. Estimate the overall drag of the newly designed aircraft for further calculation on performance of the aircraft.

LIST OF EXPERIMENTS

1.	Comparative configuration study of different types of airplanes	6
2.	Comparative study on specification and performance details of aircraft	3
3.	Preparation of comparative data sheets	3
4.	Work sheet layout procedures	6
5.	Comparative graphs preparation and selection of main parameters for the design	3
6.	Preliminary weight estimations, selection of main parameters,	3
7.	Power plant selection, Aerofoil selection, Wing tail and control surfaces	6
8.	Preparation of layouts of balance diagram and three view drawings	6
9.	Drag estimation, Weight calculation and v-n diagram	3
10.	Detailed performance calculations and stability estimates	6
		Total 45

LIST OF EQUIPMENTS

Sl.No.	Name of the Equipment	Quantity	Experiments Number
1	Engineering Drawing Board	30	3
2	Engineering Drawing Instruments	30	3

AE 2632 AIRCRAFT SYSTEM LABORATORY

L	T	P	C
0	0	3	2

GOAL

To get the practical knowledge and "On-HAND" experience in maintenance of various aircraft systems and common snags rectification procedure un various aircraft system.

OBJECTIVE

The course should enable the students to :

1. Understand the aircraft jacking up procedure and its precaution.
2. Understand the various methods of aircraft levelling and its procedure.
3. Understand the various check to be carried out to ensure the alignment of control surfaces.
4. Know the procedure and precaution of aircraft symmetry check.
5. Understand the various test carried out on hydraulic system components to assess leakage and blockage.
6. Know the procedure for carrying out the landing gear retraction test.
7. Understand the various common snags in aircraft hydraulic and fuel systems and its rectification procedure.

OUTCOME

The students should be able to :

1. Carry out aircraft jacking safely without any damage to men equipment.
2. Carry out aircraft levelling as per procedure.
3. Describe the various checks to be carry out to ensure the alignment of control surfaces.
4. Carryout aircraft symmetry check, as per procedure.
5. Carryout flow test, and pressure test on hydraulic system.
6. Describe the procedure for landing gear retraction test and various precautions to be undertaken before carrying out the test.
7. Carry out rectification of comon snags in aircraft hydraulic system as per procedure.

LIST OF EXPERIMENTS

1.	Aircraft "Jacking Up" procedure	6
2.	Aircraft "Levelling" procedure	3
3.	Control System "Rigging check" procedure	3
4.	Aircraft "Symmetry Check" procedure	3
5.	"Flow test" to assess of filter element clogging	3
6.	"Pressure Test" To assess hydraulic External/Internal Leakage	3
7.	"Functional Test" to adjust operating pressure	6
8.	"Pressure Test" procedure on fuel system components	6
9.	"Brake Torque Load Test" on wheel brake units	6
10.	Maintenance and rectification of snags in hydraulic and fuel systems.	6
		Total 45

LIST OF EQUIPMENTS

S.No.	Items	Quantity	Experiment No.
1.	Serviceable aircraft with all above systems	1	1,2,3,4,5,6,7,1,9,10
2.	Hydraulic Jacks (Screw Jack)	5	1,2,4,1
3.	Trestle adjustable	5	1,2,4,1
4.	Spirit Level	2	1
5.	Levelling Boards	2	1
6.	Cable Tensiometer	1	1
7.	Adjustable Spirit Level	1	1
8.	Plumb Bob	1	1

EL 2431 COMMUNICATION SKILLS & PERSONALITY DEVELOPMENT

L	T	P	C
2	0	2	3

GOAL

The goal of the programme is to provide the learners with the methods and materials required for becoming accomplished personalities through the medium of English.

OBJECTIVES

The course should enable the students to :

1. Be aware of self-knowledge by exposure to soft skills, values, behaviour, attitudes, temperamental changes, and a positive attitude to life.
2. Learn personality traits and undergo personality tests to determine their own personality characteristics and the scope for improvement.
3. Cultivate the art of speaking fluently making use of proper gestures, tone and voice modulation, adding humour to the speech.
4. Figure out the need to work in teams, adorn or accept team leadership, and make use of body language to enhance team spirit.
5. Be familiar with the art of managing self, people, work and time, keeping in mind problems like time-wasters and stress-builders.

OUTCOME

The students should be able to :

1. Apply the knowledge gained to improve upon their values, behaviour, attitude, and develop the soft skills required for home, workplace and the society.
2. Employ the concept of personality traits and build up an accomplished personality that would be pleasing to people around so as to influence them positively.
3. Develop a personal style and communicate fearlessly and effectively in a convincing manner so as to impress listeners or the audience.
4. Participate in presentations, group discussions, debates and mock interviews making good use of language skills and interpersonal relationships.
5. Comprehend stress-management tips to overcome stress-prone habits and develop a career plan with personal, familial and societal goals for success.

UNIT I **12**

Values and attitudes - Value-formation - Values & education - Terminal & Instrumental values - Civic responsibilities - The power of Personal/ Cultural/ Social valves -- Behaviour and attitudes -- Features of attitudes - Developing positive attitude - Overcoming negative attitude -- People skills - Soft skills as per the Work Force Profile - The four temperaments - Sanguine - Choleric - Melancholic - Phlegmatic -- Tests for Personal Chemistry.

UNIT II **12**

What is personality development - Types of personalities as per (i) Heredity (ii) Environment (iii)

Situation - the 16 personality factors - MBTI Tests - Personality types - Increasing self awareness: Assessing one's locus of control, Machiavellianism, self-esteem, self-monitoring, risk-taking, Type A, Type B personality elements - Intellectual and physical abilities for jobs -- Personality tests.

UNIT III **12**

Developing the art of speaking - How to get rid of stage fright - Enhancing fluency - Modulating voice - Enunciation - Positive and negative gestures - Preparation - How to begin? - How to convince the listeners? - How to wind up the speech - Adding humour and illustration - Developing one's own style - Types of style - How to influence the audience? - How to become an effective speaker? -- Tests for effective speaking.

UNIT IV **12**

Team work - Team building - Team leadership -- How to face an interview -- How to participate in a group discussion - How to argue for or against in a debate - Body language - Non-verbal communication - Personal appearance - Facial expression - Posture - Gestures - eye contact - Etiquette - Voluntary and involuntary body language - Gender implications -- Tests.

UNIT V **12**

Managing self, people, work, situations - Time-management - Secrets of time-management - Time-wasters - Stress -- Kinds of stress - Spotting stress - Stress-builders - Stress -management tips - Stress-prone habits -- Goals - Career planning - Interpersonal interaction - Interpersonal relationships -- Tests.

Total 60

Study material will be prepared by the Department of Languages.

Tests suggested will be prepared by a senior faculty of the department.

Movies will be screened to discuss and debate on the topics introduced in each unit.

Laboratory Requirements:

1. Career Lab:1 room
2. 2 Computers as a Server for Labs (with High Configuration)
3. Headphones with Mic (i-ball) - 100 Nos
4. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
5. Teacher table, Teacher Chair - 1 + 1
6. Plastic Chairs - 75 Nos

References:

1. Burlington, V.T. Group Interaction in High Risk Environments. Ashgate Publication, 2004.
2. Fisher, Kimball. Leading Self-directed Work Terms: A Guide to Developing New Team Leadership Skills. New York, NY : McGraw Hill, 2000.
3. Ted W. Engstrom and R. Alec Mackenzie. Managing Your Time: Practical Guidelines on the Effective Use of Time. 2008.
4. Burnard, Philip. Training Games for Interpersonal Skills. McGraw Hill, Inc., New York, 1992.
5. Greenwich, Carolyn. The Fun Factor, McGraw Hill, Inc., New York, 1997.

SEMESTER VII

AE 2701 HEAT TRANSFER

L	T	P	C
3	1	0	4

GOAL

The course is intended to build up necessary background for understanding the physical behaviour of various modes of heat transfer, like, conduction, convection and radiation

OBJECTIVES

The course should enable the students to :

1. The physical behaviour of various modes of heat transfer, like, conduction, convection and radiation.
2. The application of various experimental heat transfer correlations in engineering calculations.
3. The thermal Analysis and sizing of heat exchangers.
4. The basic concept of mass transfer, its types & its correlations.
5. Study the Heat Transfer problems in aircraft and rocket engine combustion chamber.

OUTCOME

The students should be able to :

1. Understand the difference between various modes of Heat Transfer and the Resistance Concept used in Heat Conduction.
2. Learn to use the basic methods in Conduction.Understand the concept of Lump Parameter analysis and when it is applicable and earn the concepts of boundary layer.
3. Learn to apply various correlation used in Convective Heat Transfer and Understand the concepts of Black Body, Grey Body, View factor, Radiation shielding.
4. Design/size Heat Exchanger and understand the concept of Mass transfer, its types & laws associated with it.
5. Learn to apply various technique used for high speed flow heat transfer.

UNIT I HEAT CONDUCTION **11**

Basic Modes of Heat Transfer - One dimensional steady state heat conduction: Composite Medium - Critical thickness - Effect of variation of thermal Conductivity - Extended Surfaces - Unsteady state.

Heat Conduction: Lumped System Analysis - Heat Transfer in Semi infinite and infinite solids - Use of Transient - Temperature charts - Application of numerical techniques.

UNIT II CONVECTIVE HEAT TRANSFER **12**

Introduction - Free convection in atmosphere free convection on a vertical flat plate - Empirical relation in free convection - Forced convection - Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.

UNIT III RADIATIVE HEAT TRANSFER **12**

Introduction to Physical mechanism - Radiation properties - Radiation shape factors - Heat exchange between non - black bodies - Radiation shields.

UNIT IV HEAT EXCHANGERS **13**

Classification - Temperature Distribution - Overall heat transfer coefficient, Heat Exchange Analysis - LMTD Method and E-NTU Method.

UNIT V HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING **12**

High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion chambers - Rocket thrust chambers - Aerodynamic heating - Ablative heat transfer.

TOTAL 60

TEXT BOOKS

1. Yunus A. Cengel., "Heat Transfer - A practical approach", Second Edition, Tata McGraw-Hill, 2002.
2. Incropera. F.P.andDewitt.D.P. " Introduction to Heat Transfer", John Wiley and Sons - 2002.

REFERENCES

1. Lienhard, J.H., "A Heat Transfer Text Book", Prentice Hall Inc., 1911.
2. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6thEdn., 1991.
3. Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi, 1911.
4. Mathur, M. and Sharma, R.P. "Gas Turbine and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1911.

AE 2702 HIGH TEMPERATURE MATERIALS

L	T	P	C
3	1	0	4

GOAL

To learn damage mechanism and failure of components at elevated temperatures

OBJECTIVE

The course should enable the students to :

1. Study creep behaviour and effect of different factors like stress, temporary, strain rate on creep.
2. Study design transient creep, different phenomenon like time hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monk man-Grant relationship.
3. Study fracture and various types and fracture maps for differnt alloys and oxides.
4. Study oxidation and hot corrosion; alloy additions and effect of alloying elements on oxidation and hot-corrosion.

5. Introduce super alloys and various types; different fabrication methods and inter-metallic, high temperature ceramics.

OUTCOME

The students should be able to :

1. Know about creep behaviour, and effect of different factors like stress, temporary, strain rate on creep.
2. Know about design of transient creep, time hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.
3. Know about various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, ductile fracture due to micro-void diffusion controlled void growth; fracture maps for different alloys and oxides.
4. Know about Oxidation, Pilling, Bed-worthratio, kinetic laws of oxidation-defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of corrosion.
5. Know about Iron base, Nickel base and Cobalt base super-alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Inter-metallic, high temperature ceramics.

UNIT I CREEP **9**

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

UNIT II DESIGN FOR CREEP RESISTANCE **9**

Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.

UNIT III FRACTURE **9**

Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, and ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.

UNIT IV OXIDATION AND HOT CORROSION **9**

Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation- defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.

UNIT V SUPERALLOYS AND OTHER MATERIALS **9**

Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallics, high temperature ceramics.

TOTAL : 45

TEXT BOOKS

1. Raj. R., "Flow and Fracture at Elevated Temperatures", American Society for Metals, USA, 1915.
2. Hertzberg R. W., "Deformation and Fracture Mechanics of Engineering materials", 4th Edition, John Wiley, USA, 1996.
3. Courtney T.H, "Mechanical Behavior of Materials", McGraw-Hill, USA, 1990.

REFERENCES

1. Boyle J.T, Spencer J, "Stress Analysis for Creep", Butterworths, UK, 1913.
2. Bressers. J., "Creep and Fatigue in High Temperature Alloys", Applied Science, 1911.
3. McLean D., "Directionally Solidified Materials for High Temperature Service", The Metals Society, USA, 1915.

AE 2703 COMPOSITE MATERIALS AND STRUCTURES

L	T	P	C
3	1	0	4

GOAL

Analysis and design of composite structures using moulding methods of construction, fabrication to evaluate and understand the concept of laminated plates.

OBJECTIVES

The course should enable the students to :

1. Know the types of composites
2. Understand the need for stress strain relation
3. Understand the fabrication methods
4. Understand the laminated plates
5. Study and understand the different methods & analysis of composite materials.

OUTCOME

The students should be able to :

1. Analysis of composite structures
2. Should do microscopic and macroscopic analysis
3. Should analyze sandwich and laminated plates
4. Should be aware of fabrication techniques
5. Should be able to construct and analysis different composite technique.

UNIT I STRESS STRAIN RELATION 6

Introduction- Advantages and application of composite materials, reinforcements and matrices - Generalised Hooke's Law - Elastic constants for anisotropic, orthotropic and isotropic materials.

UNIT II METHODS OF ANALYSIS 12

Micro mechanics - Mechanics of materials approach, elasticity approach to determine material properties - Macro Mechanics - Stress-strain relations with respect to natural axis, arbitrary axis - Determination of material properties. Experimental characterization of lamina.

UNIT III LAMINATED PLATES 12

Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.

UNIT IV SANDWICH CONSTRUCTIONS 8

Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT V FABRICATION PROCESS 7

Various Open and closed mould processes. Manufacture of fibers - Types of resins and properties and applications - Netting analysis.

TOTAL 45

TEXT BOOKS

1. Calcote, L R. "The Analysis of laminated Composite Structures", Von - Noastrand Reinhold Company, New York 1991.
2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1915.

REFERENCES

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons.Inc., New York, 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1919.

AE 2704 AVIONICS

L	T	P	C
3	0	0	3

GOAL

To introduce the basic concepts of navigation & communication systems of aircraft.

OBJECTIVES

The course should enable the students to :

1. Understand the needs for avionics for both Civil and military aircraft.
2. Introduce various digital electronic principles and working operations of digital circuit.

3. Integrate the digital electronics with cockpit equipments
4. Understand the various principles in flight desk and cockpit panels.
5. Study the communication and navigation equipment

OUTCOMES

The students should be able to :

1. Use his general awareness for design and fabrication of modern aircraft cockpit. Appreciate the need for avionics and Role of avionics
2. Identify various cockpits in real time
3. Should identify the real time applications of Microprocessor in aircraft
4. Apply basic concepts to a/c instruments for efficient output.
5. Awareness of communication and navigation systems and their applications.

UNIT I INTRODUCTION TO AVIONICS 6

Need for Avionics in civil and military aircraft and space systems - Integrated Avionics and Weapon system - Typical avionics sub systems - Design and Technologies.

UNIT II PRINCIPLES OF DIGITAL SYSTEMS 10

Digital Computers - Microprocessors - Memories

UNIT III DIGITAL AVIONICS ARCHITECTURE 6

Avionics system architecture-Data buses MIL-STD 1553-B, ARINC 429-ARINC 629.

UNIT IV FLIGHT DECK AND COCKPITS 8

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and military cockpit : MFDS, HUD, MFK, HOTAS

UNIT V INTRODUCTION TO AVIONICS SYSTEMS 15

Communication Systems - Navigation systems - Flight control systems - Radar electronic Warfare - Utility systems Reliability and maintainability - Certification.

TOTAL 45

TEXT BOOKS

1. Malcrno A.P. and Leach, D.P., "Digital Principles and Application", Tata McGraw-Hill, 1990.
2. Gaonkar, R.S., "Microprocessors Architecture - Programming and Application", Wiley and Sons Ltd., New Delhi, 1990.
3. R.P.G. Collinson, "Introduction to Avionics", Chapman & Hall Publications, 1996.

REFERENCES

1. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1919.
2. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1917.
3. Brain Kendal, "Manual of Avionics", The English Book HOuse, 3rd Edition, New Delhi, 1993.

AE 2705 ROCKET AND MISSILES

L	T	P	C
3	1	0	4

GOAL

To introduce basic concepts of design and trajectory estimation of rocket and missiles, to study the performance of rocket and missiles under various operating conditions and the fundamentals of design concepts.

OBJECTIVE

The course should enable the students :

1. To know the various system of rocket, its functions and operations.
2. To know the working principle and system in rockets.
3. To understand the Aerodynamics of Rockets, Missiles and Airframe Components.
4. To study the Rocket Motion in Free Space and Gravitational Field.
5. Determination of range and Altitude Simple Approximations to Burnout Velocity.
6. To know the Staging and Control of Rockets and Missiles.
7. Selection of Materials for Rockets and Missiles.

OUTCOME

The students should be able to :

1. Design Consideration of liquid Rocket Combustion Chamber.
2. Design Considerations of Igniter and types of igniters.
3. Describe the drag and lift forces acting on rocket and missile.The various methods of
4. Describing Aerodynamic Forces and Moments.Lateral Damping Moment and Longitudinal Moment of a Rocket.
5. Explain the One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields.
6. Explain the description of Vertical and Inclined and Gravity Turn Trajectories.It will give the various methods of thrust determinations and thrust vector control. It will also describe the rockets Separation Techniques.
7. Understanding of selection criteria for materials and Special Requirements of Materials to Perform under Adverse Conditions.

UNIT I ROCKET SYSTEMS **10**

Ignition System in rockets - types of Igniters - Igniter Design Considerations - Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems - Propellant Slosh and Propellant Hammer - Elimination of Geysering Effect in Missiles - Combustion System of SolidRockets.

UNIT II AERODYNAMICS OF ROCKETS AND MISSILES **13**

Airframe Components of Rockets and Missiles - Forces Acting on a Missile While Passing Through Atmosphere - Classification of Missiles - methods 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 - Numerical Problems.

UNIT III ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD **10**

One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields - description of Vertical, Inclined and Gravity Turn Trajectories - Determination of range and Altitude Simple Approximations to Burnout Velocity.

UNIT IV STAGING AND CONTROL OF ROCKETS AND MISSILES **7**

Rocket Vector Control - Methods - Thrust determination - SITVC - Multistaging of rockets -Vehicle Optimization - Stage Separation Dynamics - Separation Techniques.

UNIT V MATERIALS FOR ROCKETS AND MISSILES **5**

Selection of Materials - Special Requirements of Materials to Perform under Adverse Conditions.

TOTAL : 45

TEXT BOOK

1. Sutton, G.P., et al., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1993.

REFERENCES

1. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1991.
2. Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W., Freeman & Co. Ltd., London, 1912.
3. Parket, E.R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1912.

AE 2731 AVIONICS LABORATORY

L	T	P	C
0	0	3	2

GOAL

This laboratory is divided into three parts to train the students to learn about basic digital electronics circuits, programming with microprocessors, design and implementation of data buses in avionics with MIL - Std. 1553-B and remote terminal configuration and their importance in different applications in the field of Avionics.

OBJECTIVES

The course should enable the students to :

1. Understand the addition, subtraction of binary numbers using logic gates.
2. Know about the multiplexer and demultiplexer circuits, encoder and decoder circuits.
3. Understand the addition, subtraction for 8-bit and 16-bit numbers using microprocessor.
4. Understand the ascending and descending order of data in microprocessor.
5. Understand the series with or without carry in microprocessor.
6. Understand the avionics data bus MIL STD. 1553-B.

OUTCOME

The students should be able to :

1. Describe the logic gates and truth table for addition, subtraction.
2. Carry out the multiplexer and demultiplexer, encoding and decoding circuits in digital electronics.
3. Understand the addition, subtraction concepts and storing the data in microprocessor.
4. Understand the data flow by ascending or descending order.
5. Understand how the microprocessor handles the carry data.
6. Understand the avionics data bus MIL STD. 1553-B and how the data's are transmitting and receiving.

LIST OF EXPERIMENTS

DIGITAL ELECTRONICS **15**

1. Addition/Subtraction of binary numbers.
2. Multiplexer/Demultiplexer Circuits.
3. Encoder/Decoder Circuits.
4. Timer Circuits, Shift Registers, Binary Comparator Circuits.

MICROPROCESSORS **20**

5. Addition and Subtraction of 8-bit and 16-bit numbers.
6. Sorting of Data in Ascending & Descending order.
7. Sum of a given series with and without carry.

8. Greatest in a given series & Multi-byte addition in BCD mode.

9. Interface programming with 4 digit 7 segment Display & Switches & LED's.

10. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

AVIONICS DATA BUSES **10**

11. Study of Different Avionics Data Buses.

12. MIL-Std - 1553 Data Buses Configuration with Message transfer.

13. MIL-Std - 1553 Remote Terminal Configuration.

Total 45

LIST OF EQUIPMENT

S.No.	Details of Equipments	Quantity	Experiment Nos.
1.	Adder/Subtractor Binary bits Kit	6	1
2	Timer Kit	6	1
3	Encoder Kit	6	3
4	Decoder Kit	6	3
5	Comparator Kit	6	4
6	Multiplexer Kit	6	2
7	Demultiplexer Kit	6	2
8	Shift Registers Kit	6	4
9	Microprocessor 8085 Kit	9	5,6,7,8,9
10	4 Digit 7 Segment Display	3	9
11	Switches & LED's Circuit	3	9
12	16 Channel AD Converter	6	10
13	Digital to Analog Converter	6	10
14	Cathode Ray Oscilloscope	3	9,10
15	Regulated Power Supply (5V DC)	9	1, 2,3,4
16	MIL-Std 1553B Setup with Remote Terminal	1	12,13
17	Computers	2	11,12,13

AE 2732 AERO ENGINE REPAIR & MAINTENANCE LABORATORY

L	T	P	C
0	0	3	2

GOAL

To make the students to understand the maintenance and repair procedures of both Piston and Gas Turbine Engines and their procedures followed for overhaul of aero engines.

OBJECTIVES

The course should enable the students to :

1. Understand the procedure for stripping of piston engines
2. Know the detailed procedure for cleaning, inspection & NDT checks on Piston engine components.
3. Understand the procedure & Precautions of Piston engine Re-assembly.
4. Know the detailed procedure for stripping of Aircraft Gas Turbine Engine(APU)
5. Familiarise with various checks carried out on Aircraft Gas Turbine Engine components
6. Know the procedure and precautions to be followed for Re-assembly of an APU.
7. Study the Piston and Gas Turbine Engine starting procedure.
8. Study of different types of propellers and its pitch setting.

OUTCOME

The students should be able to :

1. Carry out stripping of aircraft piston engine as per standard procedure.
2. Carry out dimensional check and NDT checks on piston engine components.
3. Carry out Piston engine Re-assembly as per standard procedure.
4. Carryout stripping of APU with proper precautions.
5. Carryout NDT checks and dimensional checks on Aircraft Gas Turbine Engine components.
6. Carry out re-assembly of an APU as per standard procedures.
7. Understand the precautions of Aero engine with precautions.
8. Describe the types of propeller and it's pitch setting.

LIST OF EXPERIMENTS

1.	Stripping of a piston engine	6
2.	Engine (Piston Engine) - cleaning, visual inspection, NDT checks.	3
3.	Piston Engine Components - dimensional checks.	3
4.	Piston - Engine reassembly.	6
5.	Propeller Pitch Setting	3
6.	Stripping of a jet engine	6

7.	Jet Engine - identification of components & defects.	6
8.	Jet Engine - NDT checks and dimensional checks	3
9.	Jet Engine - reassembly.	6
10.	Engine starting procedures	3
		Total 45

LIST OF EQUIPMENTS

Sl.No	Equipments	Qty	Experiments No.
1	Piston Engines	2	1,2,3,4
2	Jet Engines	2	6,7,1,9
3	Propeller pitch setting stand	1	5
4	Aircraft with serviceable stand	1	1 to 10
5	Precision instruments (VernierCaliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector and DTI	2 each	3,5,1
6	NDT Equipments (Defectoscope, Dyepenetrant method, Hot oil Chalk Method	1 each	2,1

SEMESTER-VIII

AE 2831 PROJECT & VIVA VOCE

L	T	P	C
0	0	24	6

PREREQUISITES

AE 2302, AE 2303, AE 2403, AE2404.AE2501,AE2502,AE2503

GOAL

To impart and improve the design capability of the students in Aeronautical Engineering.

OBJECTIVES

To enable the students to work on a project involving theoretical and experimental studies related to Aeronautical Engineering.

OUTCOME

The students will be able to widen their knowledge based on the experimental or theoretical studies carried out in any one of the Aeronautical Engineering areas such as Aerodynamics, Propulsion, Aircraft Structures and Aerospace.

Students shall work in convenient groups of not more than four members in a group. Every Project Work shall have a Guide who is a member of the faculty of the University. Twenty four periods per week shall be allotted in the Time Table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis or field work as assigned by the Guide and also to present in periodical seminars the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, Project work details and conclusions. This final report shall be typewritten form as specified in the guidelines.

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks : 20 marks

   (Decided by conducting 3 reviews by the guide appointed by the Institution)

2. Evaluation of Project Report : 30 marks

   (Evaluated by the external examiner appointed by the University).

3. Viva voce examination : 50 marks

(Evaluated by the internal examiner appointed by the HOD, external examiner appointed by the University)

ELECTIVE

SEMESTER V

AE 2551 COMPUTER INTEGRATED MANUFACTURING

L	T	P	C
3	0	0	3

GOAL

Computer Integrated Manufacturing aims in portraying the flexible manufacturing system and the ability of user to interact with the system to increase the production by software interfacing.

OBJECTIVE

The course should enable the students to :

1. Understand the basic components of CIM,product planning and production management
2. Know the application of Group technology and CAD/CAM,CAPP process
3. Know the Shop floorcontrol and SIM architecture
4. Know the application of CMS in data communication systems
5. Understand the open system databases for CIM industry.

OUTCOME

The students should be able to :

1. Able to understand the CIM wheel and the sequences to be followed while manufacturing a product in industry
2. Able to work in the CAD ,CAMP softwares for the product design
3. Understand the shop floor management and CIMOSA for effective production management
4. Carry out the steps involved in CMS data communication systems while handling a product
5. Apply the concepts of open system database for effective and efficient product management.

UNIT I INTRODUCTION 8

The meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company- marketing engineering - production planning - plant operations - physical distribution- business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

History of group technology- role of G.T. in CAD/CAM integration - part families - classification and coding - DCLASS and MICLASS and OPITZ coding systems-facility design using G.T. - benefits of G.T. - cellular manufacturing.

Process planning - role of process planning in CAD/CAM integration - approaches to computer aided process planning - variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

Shop floor control-phases -factory data collection system -automatic identification methods- Bar code technology-automated data collection system.

FMS-components of FMS - types -FMS workstation -material handling and storage systems- FMS layout -computer control systems-application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION 10

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram CIM open system architecture (CIMOSA)- manufacturing enterprise wheel-CIM architecture- Product data management-CIM implementation software.

Communication fundamentals- local area networks -topology -LAN implementations - network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP).Development of databases -database terminology- architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

TOTAL 45

TEXT BOOK

1. Mikell.P.Groover "Automation, Production Systems and computer integrated manufacturing", Pearson Education 2001.

REFERENCES

1. Yoremkoren, "Computer Integrated Manufacturing System", McGraw-Hill, 1913.
2. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International, 1916.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc.
4. Roger Hanman "Computer Intergrated Manufacturing", Addison - Wesley, 1997. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., New Delhi-1, 1991.
5. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
6. Radhakrishnan P, SubramanyanS.and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd., New Delhi, 2000.

GE2001 PROFESSIONAL ETHICS AND HUMAN VALUES

L	T	P	C
3	0	0	3

GOAL

To introduce the students to basic concepts of Engineering Ethics and Human Values.

OBJECTIVES

The course should enable the students to :

1. Create an awareness on Human Values.
2. Be familiar with the various theories on Engineering Ethics.
3. Throw light on moral social values and Loyalty of professional.
4. Create am awareness about the safety aspects responsibilities and various rights of professionals.

OUTCOME

The students should be able to :

1. Gain knowledge in Human values.
2. Use the senses of Engineering Ethics and ethical theories..
3. Be acquainted with the Global issues on Environmental Ethics and Computer Ethics.
4. Get awareness on the Ethics and responsibilities of a professional.
5. Get awareness on Engineering Ethics and Human Values.

UNIT I HUMAN VALUES **10**

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 - Spirituality

UNIT II ENGINEERING ETHICS **9**

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 **9**

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 **9**

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 8

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.

TOTAL 45

TEXT BOOKS

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

REFERENCES

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

AE 2552 AIRCRAFT DESIGN

L	T	P	C
3	0	0	3

GOAL

Computer Integrated Manufacturing aims in portraying the flexible manufacturing system and the ability of user to interact with the system to increase the production by software interfacing.

OBJECTIVES

The course should enable the students to :

1. Understand the basic types and configurations of aircraft layouts,Maneouvering loads on tail planes
2. Know the different types of power plants and characteristics of propeller and its configurations
3. Know the basic manoeuvres such as gliding flight and calculations of takeoff and landing
4. Know the layout of special designs and specifications of aircraft
5. Understand the structural design of fuelage,wing and other aircraft parts.

OUTCOME

The students should be able to :

1. Understand the basic configurations of aircraft layouts and balancing loads effects on aircraft
2. Identify the power plant and the procedures for the propeller configuration
3. Solve the calculations of take off and landing, gliding and manoeuvring flight
4. Be clear in design of new prototype of aircrafts and able to present new layout or plan
5. Understand the various designs of wing,fuselage,U/C and other aircraft parts with good knowledge about the aircraft materials.

UNIT I REVIEW OF DEVELOPMENTS IN AVIATION 12

Categories and types of aircraft specifications - various configurations - Layouts and their relative merits - strength, stiffness, fail safe and fatigue requirements - Manoeuvering load factors - Gust and manoeuvrability envelopes - Balancing and maneuvering loads on tail planes.

UNIT II POWER PLANT TYPES AND CHARACTERISTICS 12

Characteristics of different types of power plants - Propeller characteristics and selection - Relative merits of location of power plant.

UNIT III PRELIMINARY DESIGN 12

Selection of geometric and aerodynamic parameters - Weight estimation and balance diagram - Drag estimation of complete aircraft - Level flight, climb, take - off and landing calculations - range and endurance - static and dynamic stability estimates - control requirements.

UNIT IV SPECIAL PROBLEMS 12

Layout peculiarities of subsonic and supersonic aircraft - optimisation - of wing loading to achieve desired performance - loads on undercarriages and design requirements.

UNIT V STRUCTURAL DESIGN 12

Estimation of loads on complete aircraft and components - Structural design of fuselage, wings and undercarriages, controls, connections and joints. Materials for modern aircraft - Methods of analysis, testing and fabrication.

TOTAL : 60

REFERENCES

1. G. Corning, "Supersonic & Subsonic Airplane Design", II Edition, Edwards Brothers Inc., Michigan, 1953.
2. E.F. Bruhn, "Analysis and Design of Flight Vehicle Structures", Tristate Offset Co., U.S.A., 1980.
3. A.A. Lebedenski, "Notes on airplane design", Part-I, I.I.Sc., Bangalore, 1971.
4. E. Torenbeek, "Synthesis of Subsonic Airplane Design", DelftUniversity Press, London, 1976.
5. D.P. Raymer, "Aircraft conceptual design", AIAA Series, 1988.
6. H.N.Kota, " Integrated design approach to Design fly by wire" Lecture notes Interline Pub. Bangalore, 1992.
7. S.C. Keshu& K.K. Ganapathi "Aircraft Production Techniques and Management", 1995.

AE 2553 CIVIL AVIATION REQUIRMENTS - I

L	T	P	C
3	0	0	3

GOAL

To make the students to understand the Indian aviation rules 1937, relating to aviation and civil aviation requirement in India (DGCA).

OBJECTIVES

The course should enable the students to :

1. Enhance the knowledge of aircraft act1934, and aircraft rules.
2. Understand the responsibility of owner/operator of a/c and objective of CAD.
3. Understand the procedure for the preparation of MEL, from MMEL.
4. Enhance the knowledge on the different types of maintenance programme their approval.
5. Understand the procedure for getting the approvals of organizations in different categories.

OUTCOME

The students should be able to :

1. Describe the Indian aircraft rules and the related publications.
2. Know the procedure for keeping the aircraft in airworthiness conditions.
3. Describe the use of MEL, and the procedure for releasing the a/c under MEL.
4. Describe the different types of maintenance programme.
5. Understand the requirements for getting AO in different categories.

UNIT I INDIAN AIRCRAFT RULES 1937 AND RELATED PUBLICATIONS 4

Knowledge of aircraft act, 1934, aircraft rules, 1937 as far as they related to airworthiness and safety of aircraft. Knowledge of civil airworthiness requirements, aeronautical information circulars, aeronautical information publications- (relating to airworthiness), advisory circulars & A.M.E. notices (NOTAMS) by DGCA.

UNIT II C.A.R. SERIES "A" &"B " 8

C.A.R. series A - procedure for issue of civil airworthiness requirements and responsibility of operators vis-à-vis air worthiness directorate:

Responsibilities of operators/owners; procedure of CAR issue, amendments etc; objectives and targets of airworthiness directorate; airworthiness regulations and safety oversight of engineering activities of operations

C.A.R. series "B" - issue approval of cockpit check list, MEL, CDL:

Deficiency list (MEL & CDL); preparation and use of cockpit check list and emergency check list.

UNIT III C.A.R. SERIES "C" 8

C.A.R. series 'C' - defect recording, monitoring, investigation and reporting: Defect recording, reporting, investigation, rectification and analysis; flight report, recording of in-flight instrument, reading and reporting of flight defects and rectification of defects observed on aircraft.

C.A.R. series 'D - and aircraft maintenance programmes:

Reliability programmes (engines); aircraft maintenance programmes & their approval: on condition maintenance of reciprocating engines; TBO - revision programme.

UNIT IV C.A.R. SERIES "E" 10

C.A.R. Series E - approval of organizations:

Approval of organizations in categories A, B, C, D, E, F, & G; requirements of infrastructure at stations other than parent base.

UNIT V C.A.R. SERIES "F " 15

C.A.R. Series "F" airworthiness and continued airworthiness:

Procedure relating to registration of aircraft; procedure for issue / revalidation of type certification of aircraft and its engines / propellers; issue /revalidation and renewal of certificate of airworthiness; require for renewal of certificate of airworthiness. Suspensions of certificate of airworthiness and its subsequent revalidation; rebuilding of aircraft, continuous airworthiness maintenance programme; airworthiness of ageing aircraft; control system-duplicate inspection, Inspection of wooden aircraft; airworthiness requirements of gliders, requirements of manufacture , registration & airworthiness control of hot air balloons; approval of flight manuals and their amendments ; pooling of aircraft parts by national airlines of India with foreign airlines construction, certification and operation of experimental / amateur built aircraft; manufacture of aircraft and accessories and airworthiness certification thereof; age of aircraft to be imported for charter hire " air taxi and other operations", import/export of aircraft, item of equipment etc . For use on aircraft; load and trim sheet - requirements thereof.

TOTAL 45

REFERENCE

1. Aircraft manual (India) volume - latest edition, the English book store, 17-I, Connaught circus, New Delhi.
2. Civil aviation requirements with latest amendment (section 2 airworthiness) - published by DGCA, the English book store, 17-I, Connaught circus, New Delhi.
3. Aeronautical information circulars (relating to airworthiness) from DGCA. Advisory circulars fromDGCA.

AE 2554 AIRCRAFT GENERAL ENGINEERING MAINTENANCE & PRACTICES

L	T	P	C
3	0	0	3

GOAL

To understand the various Aircraft engine maintenance procedures and standard tools for checks in aircraft engine.

OBJECTIVES

The course should enable the students to :

1. Understand the Ground Handling of Aircraft and special procedures such as Mooring, Jacking etc.
2. Study the Air conditioning and pressurization systems
3. Study the safety precautions in aircraft maintenance procedures
4. Study the Various inspections and ATA specifications while Aircraft maintenance
5. Study the Aircraft Hardware systems and their procedures of implementation.

OUTCOME

The students should be able to :

1. The ground handling procedures and types of equipments with special maintenance
2. The ground servicing of sub systems in Aircraft
3. The shop safety, Environment cleanliness in an aircraft materials shop
4. The FAA airworthiness regulations and the checklist involved in each inspection of aircraft
5. The terminology and specifications involved in Aircraft hardware selection. Identification of fluid line fittings.

UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT 10

Mooring, jacking, levelling and towing operations - Preparation - Equipment - precautions - Engine starting procedures - Piston engine, turboprops and turbojets - Engine fire extinguishing - Ground power units.

UNIT II GROUND SERVICING OF VARIOUS SUB SYSTEMS 8

Air conditioning and pressurization - Oxygen and oil systems - Ground units and their maintenance.

UNIT III MAINTENANCE OF SAFETY 5

Shop safety - Environmental cleanliness - Precautions.

UNIT IV INSPECTION 10

Process - Purpose - Types - Inspection intervals - Techniques - Checklist - Special inspection - Publications, bulletins, various manuals - FAR Air worthiness directives - Type certificate Data Sheets - ATA specifications.

UNIT V AIRCRAFT HARDWARE, MATERIALS, SYSTEMS PROCESSES 12

Hand tools - Precision instruments - Special tools and equipments in an airplane maintenance shop - Identification terminology - Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws etc.) - American and British systems of specifications - Threads, gears, bearings, etc. - Drills, tapes & reamers. - identification of all types of fluid line fittings. Materials, metallic and non-metallic - Plumbing Connectors - Cables - Swaging procedures, tests, Advantages of swaging over splicing.

TOTAL 45

TEXT BOOK

1. KROES WATKINS DELP, "Aircraft Maintenance and Repair" - McGraw-Hill, New York 1993.

REFERENCES

1. A & P MECHANICS, "Aircraft hand Book" - F. A. A. Himalayan Book House, New Delhi, 1996.
2. A & P MECHANICS, "General hand Book" - F. A. A. Himalayan Book House, New Delhi, 1996.

ELECTIVE

SEMESTER VI

AE 2651 FINITE ELEMENT METHOD

L	T	P	C
3	0	0	3

GOAL

Finite Element Method capable of writing to solve different problems such as Boundary value problems, Linear equation to approximate the solution stepwise integration algorithms have to written in Mathematical Script.

OBJECTIVES

The course should enable the students to :

1. Understand the basic steps in finite element method and convergence criteria
2. Discretize the domain in to finite elements and to obtain stiffness matrix for bar, beam and frame elements.
3. Know the plane stress and plane strain problem application in 2d structures.
4. Know the application of isoparametric problems in 3d structures.
5. Understand the application of finite element methods in heat transfer and fluid flow problems.

OUTCOME

The students should be able to :

1. Write flow chart of finite element steps and understand the convergence of the problem
2. Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
3. Plane stress and plane strain condition are used to understand 2d structures.

4. Modelling of 2d and 3d structures using isoparametric elements

5. Apply the concepts of finite element methods to solve fluid flow and heat transfer problems.

UNIT I INTRODUCTION **4**

Review of basic analysis - Stiffness and Flexibility matrix for simple cases - Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS **12**

Bar, Frame, beam elements - Application to static, dynamic and stability analysis.

UNIT III CONTINUUM ELEMENTS **10**

Various types of 2-D-elements Application to plane stress, plane strain and axisymmetric problems.

UNIT IV ISOPARAMETRIC ELEMENTS **10**

Applications to two and three-dimensional problems.

UNIT V FIELD PROBLEM **9**

Applications to other field problems like heat transfer and fluid flow.

TOTAL 45

TEXT BOOK

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall India, Third Edition, 2003.

REFERENCES

1. Reddy J.N. "An Introduction to Finite Element Method", McGraw-Hill, 2000.

2. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw-Hill, 2000.

3. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1915.

AE 2652 AIR TRANSPORTAION AND AIRCRAFT MAINTENANCE

L	T	P	C
3	0	0	3

GOAL

To study the concepts of air transportation and the maintenance management of aircraft

OBJECTIVES

The course should enable the students to :

1. Know about fundamentals of Air Transportation

2. Understand the Airline Economics

3. Understand the Principles of Airline Scheduling

4. Study the Aircraft Reliability

5. Study the Technology in Aircraft Maintenance

OUTCOME

The students should be able to understand :

1. The developments and organization structure of an Airline
2. The Fleet planning, the aircraft selection process, operating cost , Valuation & Depreciation 3. etc.,
3. The Flight operations, and crew scheduling and details about Flight planning.
4. The Maintenance schedule & its determinations
5. The Air traffic control and Navigation aids

UNIT I INTRODUCTION 8

Development of air transportation, comparison with other modes of transport - Role of IATA, ICAO - The general aviation industry airline - Factors affecting general aviation, use of aircraft, airport: airline management and organisation - levels of management, functions of management, Principles of organisation planning the organisation - chart, staff departments & line departments.

UNIT II AIRLINE ECONOMICS 10

Forecasting - Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. - Passenger fare and tariffs - Influence of geographical, economic & political factors on routes and route selection.

FLEET PLANNING: The aircraft selection process - Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition - Valuation & Depreciation - Budgeting, Cost planning - Aircrew evaluation - Route analysis - Aircraft evaluation.

UNIT III PRINCIPLES OF AIRLINES SCHEDULING 10

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule - hub & spoke scheduling, advantages / disadvantages & preparing flight plans - Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV AIRCRAFT RELIABILITY 9

Aircraft reliability - The maintenance schedule & its determinations - Condition monitoring maintenance - Extended range operations (EROPS) & ETOPS - Ageing aircraft maintenance production.

UNIT V TECHNOLOGY IN AIRCRAFT MAINTENANCE 8

Airlines scheduling (with reference to engineering) - Product support and spares - Maintenance sharing - Equipments and tools for aircraft maintenance - Aircraft weight control - Budgetary control.

On board maintenance systems - Engine monitoring - Turbine engine oil maintenance - Turbine engine vibration monitoring in aircraft - Life usage monitoring - Current capabilities of NDT - Helicopter maintenance - Future of aircraft maintenance.

TOTAL 45

TEXT BOOKS

1. FEDRIC J.H., "Airport Management", 2000.
2. C.H. FRIEND, "Aircraft Maintenance Management", 2000.

REFERENCES

1. GENE KROPF, "Airline Procedures".
2. WILSON& BRYON, "Air Transportation".
3. PHILIP LOCKLIN D, "Economics of Transportation".
4. "Indian Aircraft manual" - DGCA Pub.
5. ALEXANDER T WELLS, "Air Transportation", Wadsworth Publishing Company, California, 1993.

AE 2653 AIRFRAME MAINTENANCE & REPAIR PRACTICES

L	T	P	C
3	0	0	3

GOAL

Airframe Maintenance & Repair deals with the maintenance and safety precautions and procedures of airframe systems and their troubleshooting practices.

OBJECTIVES

The course should enable the students to :

1. Understand the basic steps in welding and soldering, brazing of aircraft components
2. Depict the composite and plastic components maintenance in aircraft industry
3. Gain knowledge about rigging, jacking of aircraft in maintenance hangar. To explain the steps involved in the maintenance process
4. Know about Hydraulic and Pneumatic system.
5. Understand the safety practices in aircraft maintenance and equipment handling

OUTCOME

The students should be able to :

1. Explain the welding, brazing process with the requirements of the process and significance of NDT
2. Understand the various maintenance practices in plastic and composite parts of aircraft
3. Understand the precautionary steps involved in rigging, jacking process.
4. Gain thorough understanding in parts, working methodology of basic aircraft systems.
5. Get a clear idea about safety practices and troubleshooting of an aircraft.

UNIT I WELDING IN AIRCRAFT STRUCTURAL COMPONENTS 10

Equipments used in welding shop and their maintenance - Ensuring quality welds - Welding jigs and fixtures - Soldering and brazing.

SHEET METAL REPAIR AND MAINTENANCE

Inspection of damage - Classification - Repair or replacement - Sheet metal inspection - N.D.T. Testing - Riveted repair design, Damage investigation - reverse technology.

UNIT II PLASTICS AND COMPOSITES IN AIRCRAFT 10

Review of types of plastics used in airplanes - Maintenance and repair of plastic components - Repair of cracks, holes etc., various repair schemes - Scopes.

Inspection and Repair of composite components - Special precautions - Autoclaves.

UNIT III AIRCRAFT JACKING, ASSEMBLY AND RIGGING 8

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces - Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

UNIT IV REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM 10

Trouble shooting and maintenance practices - Service and inspection. - Inspection and maintenance of landing gear systems. - Inspection and maintenance of air-conditioning and pressurisation system, water and waste system. Installation and maintenance of Instruments - handling - Testing

Inspection. Inspection and maintenance of auxiliary systems - Fire protection systems - Ice protection system - Rain removal system - Position and warning system - Auxiliary Power Units (APUs)

UNIT V SAFETY PRACTICES 7

Hazardous materials storage and handling, Aircraft furnishing practices - Equipments. Trouble shooting - Theory and practices.

Total 45

TEXT BOOK

1. KROES, WATKINS, DELP, "Aircraft Maintenance and Repair", McGraw-Hill, New York,1992.

REFERENCES

1. LARRY REITHMEIR, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.

2. BRIMM D.J. BOGGES H.E., "Aircraft Maintenance", Pitman Publishing corp. New York, 1940.

MG 2002 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Goal

To understand the Total Quality Management concepts and principles and the various tools available to achieve Total Quality Management and also to understand the statistical approach for quality control.

OBJECTIVES

The course should enable the students to :

1. Understand the basic concepts of Total Quality Management.
2. Be familiar with the total quality management principles.
3. Know about the various process control tools available to achieve Total Quality Management.
4. Study about quality function deployment and total productive maintenance.
5. Get awareness about the ISO certification process and their need in various industries.

OUTCOME

The students should be able to :

1. Apply the concepts of quality planning, quality control etc., in the appropriate places.
2. Apply the total quality management principles in issues like customer complaints, customer retention, relationship development etc.,
3. Describe the tools of quality, management tools, process capability etc.,
4. Describe quality function deployment and total productive maintenance.
5. Implement the quality systems for various industries.

UNIT I INTRODUCTION **9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership - Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES **9**

Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) **9**

The seven tools of quality, Statistical Fundamentals - Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS **9**

Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 - Concept, Requirements and Benefits.

TOTAL 45

TEXT BOOK

1. DaleH.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2004.

REFERENCE BOOKS

1. JamesR.Evans& William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V. "Total Quality Management", McGraw Hill, 2004.
3. Oakland.J.S. "Total Quality Management Butterworth", Heinemann Ltd., Oxford. 2005.
4. Narayana V. and Sreenivasan, N.S. Quality Management - Concepts and Tasks, New Age International.

AE 2654 CIVIL AVIATION REQUIREMENTS - II

L	T	P	C
3	0	0	3

OBJECTIVES

The course should enable the students to :

1. Understand the aircraft fuelling procedure and its precaution while fuelling.
2. Know the storage, handling and quality control of aviation fuel.
3. Know the overall and periodical inspection various aircraft instruments and equipments.
4. Conceive the significance of carrying out mandatory modifications and inspections.
5. Know the operational requirement to be compiled by operators for various operations.
6. Know the installation and maintenance procedure of various communication and navigation equipment.
7. Know about the storage condition and storage service life of aircraft components containing rubber parts.
8. Understand the significance and the procedure of flight test.
9. Know the various log books, documents, used in aircrafts and its importance to ensure air worthiness.

OUTCOME

The students should be able to :

1. Carry out fuelling and de-fuelling of modern aircrafts
2. Understand the handling and quality control procedure of aviation fuel.
3. Describe the overhaul and inspection procedure of various instruments
4. Know the importance of carrying out modifications and its procedure in detail
5. Understand the minimum operational requirement for aircrafts and helicopters
6. Describe the installation and maintenance procedure of various communication, navigation and radar equipment.
7. Store the aircraft components containing rubber parts as per CAR
8. Describe the detail procedure of flight test
9. Understand the log book entry procedure and various documents to be on board during various phases of flight.

UNIT I C.A.R. SERIES 5

C.A.R. series H - requirements of aircraft fuel, fuelling of aircraft and calibration: Aircraft fuels: Unusable fuel supply - calibration of fuel quantity gauge of aircraft; aircraft fueling procedures; aviation fuel at airport - storage, handling & quality control.

UNIT II C.A.R. SERIES "I" &"L" 8

C.A.R. series I - aircraft instruments, equipment and accessories:

Aircraft instruments overhaul and periodical inspections; aircraft equipment and instruments; maintenance of test equipments: airworthiness procedures for clean rooms and environments for aircraft systems/accessories shop; flight data recorders, Cockpit voice recorders; GPWS; installation of airborne, Collision avoidance system .

C.A.R. series L aircraft maintenance engineer - licensing: Issue of AME license, its classification and experience requirements, complete series L

UNIT III C.A.R. SERIES "M"&"O" 12

C.A.R. series M - mandatory modifications and inspections:

Mandatory modification / inspections.

C.A.R. series O - operational requirement for aircraft:

Minimum requirements to be complied by operators; operation of commercial air transport aero planes; operation of general aviation airplanes; operation of commercial air transport helicopters; operation of general aviation helicopters; registration airworthiness and operation of hand gliders and powered hand gliders ; exit row seating ; airworthiness , maintenance and operational requirements for extended range operations with twin engine aero planes; requirements for operation of aircraft in MNPS airspace; requirements for preparation of operations manual.

Requirements for implementation of reduced vertical separation minimum; aircraft requirements required navigation performance (RNP) / area navigation (RNAV)

UNIT IV C.A.R. SERIES "R" &"S" **8**

C.A.R. series R - airborne communication, navigation &radar:Aircraft radio equipment ; installation of communication, navigation and radar equipments ; installation of mode A / C and mode S transponders; control of electromagnetic interference in modern aircraft; approval f airborne GPS in Aircraft, maintenance of airborne communication & navigation, and Radar equipment.

C.A.R. series S- storage of aircraft parts:

Storage condition and storage /service life of rubber parts and aircraft components containing rubber parts, fixation of period for determining overhaul life of reciprocating engines.

UNIT V C.A.R. SERIES "T"&"X" **12**

C.A.R. series T - flight testing of aircraft:

Flight testing of (series) aircraft for issue of C and A; flight testing on aircraft for which C and A had been previously issued.

C.A.R. series X - miscellaneous requirements:

Weight and balance control of an aircraft; provision of first aid kits & physician's kit in an aircraft; use of furnishing materials in aircraft; concessions; aircraft log books; document to be carried on board on Indian registered aircraft; procedure of aircraft for issue of taxi permit; procedure for issue of type approval of aircraft components and equipment including instruments.

TOTAL 45

REFERENCES

1. Aircraft manual (India) volume - latest edition, the English book store, 17-l, Connaught circus, New Delhi.
2. Civil aviation requirements with latest amendment (section 2 airworthiness) - published by DGCA, the English book store, 17-l, Connaught circus, New Delhi.
3. Aeronautical information circulars (relating to airworthiness) from DGCA. Advisorycirculars from DGCA.

ELECTIVE

SEMESTER VII

AE 2751 WIND TUNNEL TECHNIQUES

L	T	P	C
3	0	0	3

GOAL

Wind tunnel techniques course depicts the types,working and characteristics of wind tunnels in the laboratory. The flow characteristics, flow visualisation in the tunnel are recorded for further observations

OBJECTIVES

The course should enable the students to :

1. Understand the Nondimensional number by Buckingham theorem
2. Differentiate the wind tunnels on the basis of circuit, air flow and working..
3. Know the calibration of a wind tunnel.
4. Understand the pressure and force measurements in wind tunnel.
5. Deduce the flow visualization techniques used in the wind tunnel testing

OUTCOME

The students should be able to :

1. Solve the Buckingham theory to find the SI unit of a parameter
2. Clearly understand the working of Blow down,Indraft tunnels and their specifications
3. Know about horizontal buoyancy, Flow angularities are checked while calibration
4. Know about component axis balance and internal balances are read and understood for the measurements in wind tunnel
5. Get a clear idea about the smoke and tuft flow visualisation procedures in WT testing

UNIT I PRINCIPLES OF MODEL TESTING **6**

Buckingham Theorem - Non-Dimensional Numbers -Scale Effect Types of Similartes.

UNIT II WIND TUNNELS **8**

Classification - Special problems of Testing in Subsonic, Transonic, supersonic and hypersonic speed regions - Layouts - sizing and design parameters.

UNIT III CALIBRATION OF WIND TUNNELS **11**

Test section speed - Horizontal buoyancy - Flow angularities - Turbulence measurements - Associated instrumentation - Calibration of supersonic tunnels.

UNIT IV WIND TUNNEL MEASUREMENTS **12**

Pressure and velocity measurements - Force measurements - Three component and six component balances - Internal balances.

UNIT V FLOW VISUALIZATION **8**

Smoke and Tuft grid techniques - Dye injection special techniques - Optical methods of flow visualization.

TOTAL 45

TEXT BOOK

1. Rae, W.H. and Pope, A. "Low Speed Wind Tunnel Testing", John Wiley Publication, 1914.

REFERENCE

1. Pope, A., and Goin, L., "High Speed wind Tunnel Testing", John Wiley, 1915

AE 2752 VIBRATIONS AND AROELASTICITY

L	T	P	C
3	0	0	3

GOAL

Vibration and Aero elasticity deals with the motion of aircraft motions alongside their interactions and their vibrations.

OBJECTIVES

The course should enable the students to :

1. Understand the SHM and terminologies involved in D Alembert principle of motion
2. Divide vibrations based on parameters and their significance and characteristics
3. Know the multi degree freedom of a system and its importance.
4. Know the natural frequency of a given object by numerical method
5. Understand the application of Aero elasticity and its effects on aircraft components

OUTCOME

The students should be able to :

1. Understand the basics of vibrations and simple harmonic motion.
2. Differentiate types of vibrations according to dampness and particle motion.
3. Clearly understand the need of a multi degree of freedom particle and its characteristics.
4. Solve Rayleigh and Holzer method to find natural frequency of an object.
5. Understand the formation of Aileron reversal, flutter and wing divergence.

UNIT I BASIC NOTIONS **8**

Simple harmonic motion - Terminologies - Newton's Law - D' Alembert's principle - Energy Methods

UNIT II SINGLE DEGREE OF FREEDOM SYSTEMS **12**

Free vibrations - Damped vibrations - Forced Vibrations, with and without damping - support excitation - Vibration measuring instruments.

UNIT III MULTI DEGREES OF FREEDOM SYSTEMS **10**

Two degrees of freedom systems - Static and Dynamic couplings vibration absorber- Principal co-ordinates, Principal modes and orthogonal condition - Eigen value problems.

Hamilton's principle- Lagrangean equation and application - Vibration of elastic bodies- Vibration of strings- Longitudinal, Lateral and Torsional vibrations.

UNIT IV APPROXIMATE METHODS **5**

Rayleigh's and Holzer Methods to find natural frequencies.

UNIT V ELEMENTS OF AEROELASTICITY **10**

Concepts - Coupling - Aero elastic instabilities and their prevention - Basic ideas on wing divergence, loss and reversal of aileron control - Flutter and its prevention.

TOTAL 45

TEXT BOOKS

1. TIMOSHENKO S., "Vibration Problems in Engineering"- John Wiley and Sons, New York, 1993.
2. FUNG Y.C., "An Introduction to the Theory of Aeroelasticity" - John Wiley & Sons, New York, 1995.

REFERENCES

1. BISPLINGHOFF R.L., ASHELY H and HOGMAN R.L., "Aeroelasticity" - Addision Wesley Publication, New York, 1913.
2. TSE. F.S., MORSE, I.F., HUNKLE, R.T., "Mechanical Vibrations", - Prentice Hall, New York, 1914.
3. SCANLAN R.H. & ROSENBAUM R., "Introduction to the study of Aircraft Vibration & Flutter", John Wiley and Sons. New York, 1912.
4. BENSON H.TONGUE, "Principles of Vibration", OxfordUniversity Press, 2000.

AE 2753 FATIGUE AND FRACTURE MECHANICS

L	T	P	C
3	0	0	3

GOAL

To understand the basic characteristics of fatigue and creep mechanisms in the aircraft structures.

OBJECTIVES

The course should enable the students to :

1. Understand fatigue load
2. Understand low and high cycle fatigue
3. Understand crack initiation and growth
4. Understand potential energy and surface energy
5. Understand safe life and fail safe design

OUTCOMES

The students should be able to :

1. Become familiar with definitions
2. Analyze for cumulative damage
3. Analyze for crack initiation & crack growth
4. Analyze for strength of cracked bodies
5. Analyze damage tolerant structures

UNIT I FATIGUE OF STRUCTURES **12**

S.N. curves - Endurance limit - Effect of mean stress - Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - plastic stress concentration factors - S-N curves for typical notched geometries.

UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR **11**

Low cycle and high cycle fatigue - Coffin-Manson's relation - Transition life - Cyclic Strain hardening and softening - Analysis of load histories - Cycle counting techniques - Cumulative damage - Miner's theory - other theories.

UNIT III PHYSICAL ASPECTS OF FATIGUE **10**

Phase in fatigue life - Crack initiation - Crack growth - Final fracture - Dislocations - Fatigue fracture surfaces.

UNIT IV FRACTURE MECHANICS **15**

Strength of cracked bodies - potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - Stress analysis of cracked bodies - Effect of thickness on fracture toughness - Stress intensity factors for typical geometries.

UNIT V FATIGUE DESIGN AND TESTING **12**

Safe life and fail safe design philosophies - Importance of Fracture Mechanics in aerospace structure - Application to composite materials and structures.

TOTAL 60

TEXT BOOKS

1. Prasanth Kumar - "Elements of fracture mechanics" - Wheeter publication, 1999.
2. Barrois W, Ripely, E.L., "Fatigue of aircraft structure", Pergamon press. Oxford, 1913.

REFERENCES

1. Sin, C.G., "Mechanics of fracture" Vol. I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1919.
2. Knott, J.F., "Fundamentals of Fracture Mechanics", Buterworth& Co., Ltd., London, 1913.

ELECTIVE

SEMESTER VIII

AE 2851 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

GOAL

To make the students to understand the basic concepts of fluid dynamics and to et a clear picture of the condition of a flow in real motion.

OBJECTIVES

The course should enable the students to :

1. Understand the basic flow equations, characteristicsof mathematical models for a given flow.
2. Know the importance and significance of panel methods
3. Understand the concept of discretization, upwind differencing and implicit explicit solutions
4. Familiarize with Finite element techniques in Computational Fluid dynamics.
5. Familiarize with Finite Volume techniques in Computational fluid analysis.

OUTCOME

The students should be able to :

1. Describe the flow phenomena in a flow field with correspondence with elliptic, parabolic and hyperbolic equations
2. Clearly understand the steps involved in Source and panel methods
3. Describe the upwind concept and its effects in a given flow. Can understand the discretization of a flow model for analysis.
4. Can clearly understand the weighted variational formulae and Galerkin method for finite volume technique.

5. Know the numerical finite volume methods(RungeKutta method, Lax wendroff) in Computational analysis.

UNIT I FUNDAMENTAL CONCEPTS 10

Introduction - Basic Equations of Fluid Dynamics - Incompressible In viscid Flows: Source, vortex and doublet panel, methods - lifting flows over arbitrary bodies. Mathematical properties of Fluid Dynamics Equations -_ Elliptic, Parabolic and Hyperbolic equations - Well posed problems - discretization of partial Differential Equations -Transformations and grids - Explicit finite difference methods of subsonic, supersonic and viscous flows.

UNIT II PANEL METHODS 7

Introduction - Source panel method - Vortex panel method - Applications.

UNIT III DISCRETIZATION 8

Boundary layer Equations and methods of solution -Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation --Stability properties of explicit and implicit methods - Conservative upwind discretization forHyperbolic systems - Further advantages of upwind differencing.

UNIT IV FINITE ELEMENT TECHNIQUES 10

Finite Element Techniques in Computational Fluid Dynamics; introduction - Strong and Weak Formulations of a Boundary Value Problem - Strong formulation - Weighted Residual Formulation - Galerkin Formulation - Weak Formulation - Variational Formulation - Piecewise defined shape functions - Implementation of the FEM - The Solution Procedure.

UNIT V FINITE VOLUME TECHNIQUES 10

Finite Volume Techniques - Cell Centered Formulation - ~ Lax - Vendoroff Time Stepping - Runge - Kutta Time Stepping - Multi - stage Time Stepping - Accuracy -. Cell Vertex Formulation - Multistage Time Stepping - FDM -like Finite Volume Techniques - Central and Up-wind Type Discretization - Treatment of Derivatives.

TOTAL 45

TEXT BOOK

1. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1911.

REFERENCES

1. John F. Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer - Verlag, Berlin, 1992
2. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II. John Wiley &Sons, New York, 1911.
3. Klaus A Hoffmann and Steve T. Chiang. "Computational Fluid Dynamics for Engineers", Vols. I & II Engineering Education System, P.O. Box 20071, W.Wichita, K.S., 67201 - 1071 USA, 1993.
4. Anderson, Jr.D., "Fundamentals of Aerodynamics", McGraw-Hill, 2000.

AE 2852 AERO ENGINE MAINTENANCE & REPAIR

L	T	P	C
3	0	0	3

GOAL

To make the students to understand the basic concepts of maintenance and repair of both piston and gas turbine engines and the procedures followed for overhaul of aero engines.

OBJECTIVE

The course should enable the students to :

1. Understand the types of piston engines, principle of operation.
2. Know the inspection, maintenance and troubleshooting procedure of aircraft piston engines
3. Understand the piston engine overhaul procedure and engine testing procedure.
4. Familiarize with 112 types of jet engines and its principle of operations.
5. Understand the maintenance troubleshooting, testing procedure of gas turbine engines.
6. Understand the overhaul procedure of aircrafts gas turbine engines.
7. Familiarize with gas turbine engine, health monitoring and corrective methods.

OUTCOME

The students should be able to :

1. Describe the function of each component in piston engines and its materials.
2. Carryout inspections and maintenance checks on aircraft piston engines.
3. Describe the piston engine overhaul procedure.
4. Know the types and function of each component in gas turbine engines.
5. Describe the troubleshooting and rectification procedures of gas turbine engines.
6. Know the overhaul procedures and balancing of gas turbine components.
7. Describe the detail procedure for gas turbine engine, health monitoring.

UNIT I CLASSIFICATION OF PISTON ENGINE COMPONENTS 5

Types of piston engines - Principles of operation - Function of components - Materials used - Details of starting the engines - Details of carburetion and injection systems for small and large engines - Ignition system components - Spark plug details - Engine operating conditions at various altitudes - Maintenance and inspection check to be carried out.

UNIT II INSPECTION OF PISTON ENGINES 8

Inspection and maintenance and troubleshooting - Inspection of all engine components - Daily and routine checks - Overhaul procedures - Compression testing of cylinders - Special inspection schedules - Engine fuel, control and exhaust systems - Engine mount and super charger - Checks and inspection procedures.

UNIT III INSPECTION OF PISTON ENGINES **10**

Symptoms of failure - Fault diagnostics - Case studies of different engine systems - I: Tools and equipment requirements for various checks and alignment during overhauling - Tools for inspection - Tools for safety and for visual inspection - Methods and instruments for non destructive testing techniques - Equipment for replacement of part and their repair. Engine testing: Engine testing procedures and schedule preparation - Online maintenance.

UNIT IV CLASSIFICATION OF JET ENGINE COMPONENTS **12**

12 Types of jet engines - Principles of operation - Functions of components - Materials used - Details of starting and operating procedures - Gas turbine engine inspection & checks - Use of instruments for online maintenance - Special inspection procedures : Foreign Object Damage - Blade damage - etc.

Maintenance procedures of gas turbine engines - Trouble shooting and rectification procedures - Component maintenance procedures - Systems maintenance procedures.

Gas turbine testing procedures - test schedule preparation - Storage of Engines - Preservation and de-preservation procedures.

UNIT V OVERHAUL PROCEDURES **10**

Engine Overhaul procedures - Inspections and cleaning of components - Repairs schedules for overhaul - Balancing of Gas turbine components.Trouble Shooting - Procedures for rectification - Condition monitoring of the engine on ground and at altitude - engine health monitoring and corrective methods.

Total 45

TEXT BOOK

1. KROES & WILD, "Aircraft Power plants", 7th Edition - McGraw Hill, New York, 1994.

REFERENCES

1. TURBOMECA, "Gas Turbine Engines", The English Book Store, New Delhi, 1993.
2. UNITED TECHNOLOGIES PRATT & WHITNEY, "The Aircraft Gas turbine Engine and its Operation", (latest edition) The English Book Store, New Delhi.

AE 2853 HELICOPTER MAINTENANCE

L	T	P	C
3	0	0	3

GOAL

To make the students to understand the basic concepts of Helicopter maintenance and repair procedures followed for overhauling.

OBJECTIVE

The subject should enable the students to

1. Fundamentals of Helicopter and ground handling of bearings
2. Basic concepts of Head maintenance, vibration tracking of helicopter blades. Flight control systems and mast adjustment concepts

3. Concept of main rotor transmission, spray clutch with importance of torque meter maintenance
4. Importance of power plants and tail rotors servicing and system rigging is executed
5. Basic fuselage maintenance and special hardware requirements.

OUTCOME

The students should be able to

1. Helicopter basics are clearly understood and various maintenance procedures are followed
2. Get a clear idea about Head maintenance with flight and mast control systems.
3. Understand the transmission process in helicopter rotor and torque meter working.
4. Power plant rotors and tail rotor working is studied.Concept of rigging is clearly understood.
5. Get an idea about fuselage maintenance procedures with special hardware requirements.

UNIT I HELICOPTER FUNDAMENTALS 5

Basic directions - Ground handling, bearing - Gears.

UNIT II MAIN ROTOR SYSTEM 9

Head maintenance - blade alignment - Static main rotor balance - Vibration - Tracking - Span wise dynamic balance - Blade sweeping -Electronic balancing - Dampener maintenance - Counter weight adjustment - Auto rotation adjustments - Mast & Flight Control Rotor - Mast - Stabilizer, dampeners - Swash plate flight control systems collective - Cyclic - Push pull tubes - Torque tubes - Bell cranks - Mixer box - Gradient unit control boosts - Maintenance & Inspection control rigging.

UNIT III MAIN ROTOR TRANSMISSIONS 12

Engine transmission coupling - Drive shaft - Maintenance clutch - Freewheeling units - Spray clutch - Roller unit - Torque meter - Rotor brake - Maintenance of these components - vibrations - Mounting systems - Transmissions.

UNIT IV POWER PLANTS & TAIL ROTORS 12

Fixed wing power plant modifications - Installation - Different type of power plant maintenance. Tail rotor system - Servicing tail rotor track - System rigging.

UNIT V AIRFRAMES AND RELATED SYSTEMS 7

Fuselage maintenance - Airframe Systems - Special purpose equipment.

TOTAL 45

TEXT BOOK

1. JEPPESEN, "Helicopter Maintenance", Jeppesons and Sons Inc., 2000.

REFERENCES

1. "Civil Aircraft Inspection Procedures", Part I and II, CAA, English Book House, New Delhi, 1916.
2. LARRY REITHMIER, "Aircraft Repair Manual", Palamar Books Marquette, 1992.