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.
AEROSPACE 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 ≥ 8.0: **First Class with distinction**

6.5 ≤ CGPA < 8.0 : **First Class**

5.0 ≤ 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. AEROSPACE 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 aerospace 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 Aerospace 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

DEPARTMENT OF AEROSPACE 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 2303	Fluid Mechanics and Machinery****	3	1	0	4	4
3	AE 2304	Aircraft Materials****	3	0	0	3	3
4	AE 2302	Aero Engineering Thermodynamics****	3	1	0	4	4
5	AS 2301	Introduction to Aero Space Engineering	3	0	0	3	3
Practical							
6	AE 2331	Workshop Practice Lab****	0	0	3	2	3
7	AE 2332	Fluid Mechanics & Machinery Lab****	0	0	3	2	3
8	AE 2333	Design and Drafting Lab****	0	0	3	2	3
9	AE 2334	Thermodynamics Lab****	0	0	3	1	3
		Total				**26**	**30**

**** Common to AERONAUTICAL

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	AS 2401	Aero Space Structures - I	3	1	0	4	4
3	AE 2404	Aerodynamics - I****	3	1	0	4	4
4	AS 2402	Propulsion - I	3	1	0	4	4
5	AS 2403	Elements of Avionics	3	0	0	3	3
Practical							
6	AS 2404	Aerospace Structures Lab	0	0	3	2	3
7	AS 2405	Project Work	0	0	6	2	6
8	AE 2431	Computer Aided Design & Drafting Lab****	0	0	3	2	3
9	AS 2406	Aerodynamics Lab-I	0	0	3	2	3
		Total				**27**	**34**

****** Common to AERONAUTICAL**

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
Theory							
1	AS 2501	Aerospace Structures II	3	1	0	4	4
2	AS 2502	Flight Mechanics - I	3	1	0	4	4
3	AE 2502	Aerodynamics-II****	3	1	0	4	4
4	AS 2503	Propulsion - II	3	1	0	4	4
5	-	Elective I	3	0	0	3	3
6	-	Elective II	3	0	0	3	3
Practical							
7	AS 2504	Propulsion Lab - I	0	0	3	2	3
8	AS 2505	Aerodynamics Lab - II	0	0	3	2	3
		Total				**26**	**28**

**** Common to AERONAUTICAL

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
Theory							
1	AS 2601	Propulsion - III	3	1	0	4	4
2	AS 2602	Flight Mechanics II	3	1	0	4	4
3	AS 2603	Advanced Materials and Performance	3	0	0	3	3
4	AE 2602	Control Engineering****	3	1	0	4	4
5	-	Elective - III	3	0	0	3	3
Practical							
6	AS 2604	Propulsion Lab - II	0	0	3	2	3
7	EL 2431	Communication Skills & Personality Development	2	0	2	3	4
8	AS 2605	Aerodynamics Design Lab	1	0	3	2	4
		Total				**25**	**29**

**** Common to AERONAUTICAL

SEMESTER VII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
Theory							
1	AS 2701	Flight Mechanics III	3	1	0	4	4
2	AS 2702	Introduction to Composite Materials and Structures	3	1	0	4	4
3	AS 2703	Satellites and Space System Design	3	1	0	4	4
4	AE 2705	Rockets and Missiles****	3	1	0	4	4
5	AS 2704	High Temperature Materials	3	0	0	3	3
6	-	Elective IV	3	0	0	3	3
Practical							
7	AS 2705	Structural Design Lab	1	0	3	2	3
8	AS 2706	Space Propulsion Laboratory	0	0	3	2	3
		Total				**26**	**28**

**** Common to AERONAUTICAL

SEMESTER VIII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
Theory							
1	-	Elective - V	3	0	0	3	3
Practical							
3	AS 2801	Project Work & Viva Voce	0	0	24	6	24
		Total				**9**	**27**

Total No. of Credit 192

ELECTIVE COURSES

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
1	GE 2001	Professional ethics and Human Values	3	0	0	3	3
2	AS 2506	Aircraft Maintenance Practices	3	0	0	3	3
3	AS 2507	Aero elasticity	3	0	0	3	3
4	AS 2508	Experimental Stress Analysis	3	0	0	3	3

ELECTIVE COURSES

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
1	AS 2606	Advanced Strength of Materials	3	0	0	3	3
2	AS 2607	FEM in Aerospace	3	0	0	3	3
3	AS 2608	Theory of Combustion	3	0	0	3	3

ELECTIVE COURSES

SEMESTER VII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
1	AE 2751	Wind Tunnel techniques****	3	0	0	3	3
2	AS 2707	Design of gas Turbine	3	0	0	3	3
3	AS 2708	Introduction to NDT	3	0	0	3	3

**** Common to AERONAUTICAL

ELECTIVE COURSES

SEMESTER VIII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
1	AE2851	Computational Fluid Dynamics****	3	0	0	3	3
2	AS 2802	Fundamentals of space vehicle design	3	0	0	3	3
3	AS 2803	Cryogenic Propulsion	3	0	0	3	3

**** Common to AERONAUTICAL

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:

1) Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation.

2) Understand the Evolutes and Envelope of the curve.

3) Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation.

4) Learn partial differentiations involving two and three variables and expansions of functions using Taylor series.

5) Learn the expansions of trigonometric, hyperbolic functions and their relations.

OUTCOME

The students should be able to:

1) Identify Eigen value problems from practical areas and obtain its solutions and using transformation diagonalising the matrix which would render Eigen values.

2) Find out effectively the geometrical aspects of curvature and appreciates mathematical skills in constructing evolutes and envelopes in mechanics and engineering drawing.

3) Recognize and to model mathematically and solving, the differential equations arising in science and engineering.

4) Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation.

5) 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.

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 :

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 behaviour 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 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.

REFERENCE BOOKS

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.

CS 2101 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:

1) Gain knowledge about Microsoft office, Spread Sheet.

2) Learn a programming concept in C.

OUTCOME

The student should be able to:

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

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

3) 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 S

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) Study polymer chemistry that give an idea on the type of polymers to be used in engineering applications.

3) Gain an exposure to the common engineering materials to create awareness among the students to search for new materials.

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

5) Gain good exposure to the important aspects of basic thermodynamics that be able to understand the advanced level thermodynamics in engineering applications.

6) Understand various aspects of energy sources that 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.

REFERENCE

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) Understand the Basics & Statics of particles
2) Study the Equilibrium of rigid bodies and resolution of forces
3) Understand the basics of properties of surfaces & solids
4) Study the Dynamics of particles
5) 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) Understand the effects of over exploitation of water resources, forest resources etc. and their impact on day to day life on earth.
2) Gain knowledge on the functions of several of ecosystems will help the students to design the processes that are eco friendly.
3) Gain knowledge on the different types of pollution will help the young minds to device effective control measures to reduce rate of pollution.
4) Gain an 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) Understand 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.

OBJECTIVES

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
MA 2301 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 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 student 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) Study the Hydraulic pumps & its applications

OUTCOME

The students should be able to know about:

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 Kaplon, 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 FLIUD 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 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 BOOKS

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 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, 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 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

TOTAL 45

TEXT BOOKS

1. Lalith Gupta, "Aircraft General Engineering" Himalaya Book House, Delhi 2003
2. HajiraChowdhry, "Workshop Technology" - Vol 1 & 2, Nedia Promoters, Mumbai

REFERENCES

1. "Aircraft Material & Process", Titterton 2004
2. "Advanced Composite Materials", Lalith Gupta 2006, Himalaya Book House, Delhi

AS 2301 INTRODUCTION TO AEROSPACE ENGINEERING

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 principles behind propulsion of flight
4) Study the different structures & construction
5) Study the various types of instruments and navigation systems

OUTCOME

The students should be able to :

1) Understand the history of aircraft & developments over the years
2) Understand the types & classifications of components and configurations.
3) Understand the basic concepts of propulsion and power plants
4) Understand the types of fuselage, constructions and materials
5) Understand the different types of navigation and instruments for flight

UNIT I HISTORICAL EVALUATION **9**

History of aviation, early development of airplanes, biplanes and monoplanes, history of spaceflight, development of space vehicle, classification of duct jet propulsion, rocket propulsion, advance propulsion and applications.

UNIT II CONFIGURATIONS **9**

Anatomy of flight vehicles, components of an airplanes and their function, configuration of space vehicle, earth's atmosphere and gravitational field, bluff bodies v/s streamlined body, airfoil. lift generation, significance of L/D ratio, aerodynamic forces.

UNIT III PROPULSION **9**

Classification and essential features of propulsion, jet propulsion, general characteristics of rocket engines, theory of propulsion, elementary gas dynamics, spacecrafts and aircraft performance.

UNIT IV AEROSPACE STRUCTURES AND MATERIALS **9**

General types of construction and structural layout, flight envelope and V-n diagrams, monocoque, semimonocoque, corrugated, sandwich structure, reinforced and honeycomb structures, geodesic construction, aerospace materials, metallic and non metallic materials, use of aluminum alloy, titanium, stainless steel, composite and ceramic materials.

UNIT V INSTRUMENTS AND NAVIGATION **9**

Basic instrumentation electronics (dc electronics, ac electronics, semiconductors, electro-optics and digital electronics), sensing devices, bridge circuits, optical devices and introduction to computer based data acquisition, measurements in aerodynamics, flight structures, and flight control, principles of navigation, celestial, radio, and inertial navigation schemes, navigational and guidance requirements for orbital, planetary, and atmospheric entry missions.

TOTAL: 45

TEXT BOOKS

1. Shevel, "Fundamentals of Flight", Prentice Hall, 1989.
2. Merrill, G., "Principle of Guided Missile Design", D. Van Nostrand Co., INC., 1977

REFERENCES

1. Anderson, J. D., "Introduction to Flight", McGraw-Hill, 2000.
2. Kermode, A. C., "Flight without Formulae", Pitman, 1970

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 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

Sl.No	Details of Equipments	Qty Req.	Experiment 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 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 subject should enable the student 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 2334 THEROMODYNAMICS 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 region
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. 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

MA 2401 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.

AS 2401 AEROSPACE STRUCTURES - I

L	T	P	C
3	1	0	4

GOAL

Analysis and design simple aircraft 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) 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) 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) Apply fluid mechanics concepts
2) Model flow over wing
3) 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, Blasius solution.

TOTAL : 60

TEXT BOOK

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

AS 2402 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 and rocket propulsion.

OBJECTIVES

The course should enable the students to :

1) Know the fundamentals of gas turbines and its components
2) Know the steady one dimensional flow of perfect gas.
3) Know the different types of gas turbine engines and engine performances.
4) Study the fundamentals of rocket propulsion.
5) Study the performance of aerospace vechilces.

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.

- Understand the types and working of gas tubine engines
- Understand the types of rocket, missiles and its basic configuration
- Know the performance charectersitcs of solid, liquid and hybrid rocket..

UNIT I INTRODUCTION TO AIRCRAFT PROPULSION **11**

Introduction to propulsion , Basic thermodynamics , Fundamental equations, Types of aircraft engines Performance parameters , thrust equation , factors affecting thrust and efficiencies.

UNIT II STEADY ONE DIMENSIONAL FLOW **11**

One dimensional flow of a perfect gas, isentropic flow, non-isentropic flow , frictionless constant area flow , constant area flow with friction , without friction , normal shock and oblique shocks

UNIT III FUNDAMENTALS OF GAS TURBINE ENGINES **13**

Working principle of gas turbine engine, gas turbine cycle, turboprop, turbofan and turbojet engines -Thrust and efficiency - Methods of thrust augmentation -- Engine Performance characteristics.

UNIT IV FUNDAMENTALS OF ROCKET PROPULSION **12**

History of rocket propulsion, types of rocket, Basic configurations and application -Types of missiles and their structure, Heat transfer and cooling system in rocket , classification of Chemical rocket propulsion system.

UNIT V PERFORMANCE OF AEROSPACE VEHICLES **13**

Static performance, vehicle acceleration, performance characteristics, nozzle, solid, liquid and hybrid rocket and their propellants.

TOTAL: 60

TEXT BOOKS

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.
2. G.P Sutton & O. Biblarz, "Rocket Propulsion Elements", John Wiley & Son Inc., 2001.

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Longman, 1989.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
3. "Rolls Royce Jet Engine" - Third Edition - 1983.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors,Delhi,1999.

AS 2403 ELEMENTS OF AVIONICS

L	T	P	C
3	0	0	3

GOAL

To understand the basic concepts of avionics systems.

OBJECTIVES

The course should enable the student to :

1) Study about Need for Avionics in civil and military aircraft and space systems
2) Study about the principles of digital systems
3) Study about some of the digital avionics architecture.
4) Study about the flight deck and cockpit instruments.
5) Study about avionics systems like communication system and navigation systems.

OUTCOME

The students should be able to:

1) Understand the avionics system in weapons design and technologies are studied.
2) Understand the digital computers, microprocessors and memories are studied.
3) Understand the avionics system architecture like data bus MIL STD 1553, B ARINC 429 are studied.
4) Understand the control and display technologies like CRT, LED, LCD, EL and plasma panel are studied.
5) Understand the communication system, flight control system and radar electronic warfare.

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.

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.

AS 2404 AEROSPACE 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

AS 2405 PROJECT WORK

L	T	P	C
0	0	6	2

GOAL

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

OBJECTIVES

The course should enable the students to :

1) Impart and improve the design capability of the students in Aerospace Engineering

OUTCOME

- The student will be able to Design new aircrafts, space stations, concept engines and innovative designs related to aerospace 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).

   Every student belonging to the same group gets the same mark

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.

AS 2406 AERODYNAMICS LAB I

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.
6) 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

S.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 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

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

TOTAL 45

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. - 30 Licenses
3. Laser Printer or Plotter to print / plot drawings - 2 No.

SEMESTER - V

AS 2501 AEROSPACE STRUCTURES -II

L	T	P	C
3	1	0	4

GOAL

To study the behaviour of various aerospace structural components and 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 **11**

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

UNIT II SHEAR FLOW IN OPEN SECTIONS **13**

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 **13**

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

UNIT IV BUCKLING OF PLATES **13**

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 **10**

Shear and bending moment distribution for semi cantilever and other types of wings andFuselage, 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.

AS 2502 FLIGHT MECHANICS-I

L	T	P	C
3	1	0	4

GOAL

To study the aircraft properties and performances and to learn the drag characteristics of the airplane.

OBJECTIVES

The course should enable the student to:

1) Study about the various characteristics of aircraft.
2) Understand drag force acting on an airplane, and variations due to velocity and altitude.
3) Study about the various types of power plant and its characteristics.
4) Understand elements of airplane performance.
5) Understand the basics of helicopter mechanics

OUTCOME

The students should be able to:

1) Understand the airplane as a dynamic system, equilibrium conditions.
2) Understand the different types of drag and drag polar.
3) Understand the variation of thrust, power, SFC with velocity and altitude.
4) Understand about performance in level flight, minimum drag and power required, climbing, gliding and turning flight, VN diagram and load factor.
5) Understand the principles and mechanics behind the Helicopter flight.

UNIT I AIRCRAFT PROPERTIES **12**

The airplane as a rigid body, the airplane as a dynamic system, Equilibrium conditions, Static stability conditions, Airplane dynamics, Airplane control .Aerodynamic properties of wing and its components.

UNIT II DRAG ESTIMATION **12**

Drag aerodynamics - Dimensional Analysis, Potential flow, induced drag, Flow of viscous fluid, parasite drag, and flow of a compressible fluid. Aerodynamic data - section characteristics, plan form characteristics, high lift and control devices, Determination of three dimensional wing data. Estimation of airplane drag, low speed drag estimation, high speed drag estimation.

UNIT III PROPULSION **12**

Power plant type & efficiency, power plant data, reciprocating engine cooling drag, propeller charts.

UNIT IV AIRPLANE PERFORMANCE **12**

Performance computation ,generalized performance method, compressibility speed correction, Range and Endurance, Take - off and landing distances, acceleration in climb, turning performance, design performance.

UNIT V HELICOPTER ROTOR AERODYNAMICS AND PERFORMANCE **12**

Introduction, effect of gyroscopic precession, Torque reaction and directional control, dissymmetry of lift, Blade tip stall , Translating tendency and its correction, coriolis effect and compensation, vortex ring state, power settling, over pitching, Auto-rotation, Ground effect.

TOTAL 60

TEXT BOOKS

1. Perkins, C.D., and Hage, R.E., "Airplane Performance Stability and Control", John Wiley & soInc., New York, 1988.
2. Leishman, J.G., "Principle of Helicopter Aerodynamics", Cambridge Aerospace.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998

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 students 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 18

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 FLOW 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 I V AIRFOIL IN HIGH SPEED FLOWS **9**

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, 1982.
2. Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.
3. Mc Cornick. 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.

AS 2503 PROPULSION - II

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.

OBJECTIVES

The course should enable the student to :

1) Know the design and performance of subsonic and supersonic inlets.
2) Study the axial compressors and their working principles.
3) Study the centrifugal compressors and their working principle.
4) Know the different types of combustion chambers and factors affecting the combustors.
5) Study the types of nozzles and flow conditions in nozzles.

OUTCOME

The students should be able to :

1) Understand the internal flow and external characteristics near the inlets. Starting problems and different modes of operation in supersonic inlets.

2) Know the types and working principles of axial compressors, its velocity diagrams, blade design and performance characteristics of compressors.

3) Know about the working principles of centrifugal compressors, its velocity diagrams.

4) Understand the types and working methods in combustion chambers. The flame stabilization and flame techniques.

5) Understand the flow through nozzle, choking, losses in nozzle, variable area nozzle and thrust vectoring.

UNIT I DIFFUSER **12**

Subsonic inlet and Internal flow - Major features of external flow - Relation between minimum area ratio and external deceleration ratio - Supersonic inlets - Starting problem on supersonic inlets - Shock swallowing by area variation - External deceleration - Modes of inlet operation.

UNIT II AXIAL COMPRESSOR **12**

Working principle of axial compressor, Elementary theory - Velocity triangles, Degree of reaction - Three dimensional flow - Compressor blade design & stage performance calculation - Factors affecting stage pressure ratio , off design performance- Axial compressor performance characteristics.

UNIT III CENTRIFUGAL COMPRESSOR **12**

Working principle of centrifugal compressor - Work done and pressure rise - Inducer and impellor - Velocity diagrams - Compressor stage design - Concept of pre-whirl - Rotation stall -Centrifugal compressor performance characteristics.

UNIT IV 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 - Numerical problems.

UNIT V NOZZLES **12**

Theory of flow in isentropic nozzles - Convergent nozzles and nozzle choking - Nozzle throat conditions - Nozzle efficiency - Losses in nozzles - Over expanded , under - expanded nozzles , Ejector and variable area nozzles.

TOTAL 60

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 Co., ELBS Ed., 1989.
2. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988.

AS 2504 PROPULSION LAB - I

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 the assembly of sub systems
2) Understand aircraft piston engine's components, functions, operating principles
3) Study aircraft jet engine, and the assembly of sub systems
4) Understand aircraft jet engine's components, functions, operating principles
5) Study about forced Convective Heat transfer
6) Study about free Convective heat transfer

OUTCOME

The students should be able to:

1) Gain knowledge about the various systems of aircraft piston engine and show the systems on the engines available in the Lab
2) Learn about the working cycle of the aircraft piston engine and description of various components and its functions.
3) Gain knowledge about systems that form a jet engine by showing the systems on the engines that are available in the Aero Hangar
4) Learn about the working cycle of the aircraft jet engine and description of various components and its functions by visually them on the engines available in the Aero Hangar.
5) Understand the concept of forced convective heat transfer and perform experiment on the heat transfer apparatus
6) Understand the concept of free convection heat transfer and perform experiment on the heat transfer apparatus

LIST OF EXPERIMENTS

1.	Study of an aircraft piston engine - assembly of sub systems	6
2.	Study of an aircraft piston engine - various components, their functions and operating principles	9
3.	Study of an aircraft jet engine - assembly of sub systems,	6
4.	Study of an aircraft jet engine - various components, their functions and operating principles	9
5.	Study of forced convective heat transfer.	6
6.	Study of free convective heat transfer.	9

TOTAL : 45

LIST OF EQUIPMENTS

Sl.No	Equipments	Qty	Experiments No.
1	Piston engines	2	1,2
2	Jet Engine /Engine model	1	3,4
3	Forced Convective apparatus	1	5
4	Free Convective apparatus	1	6

AS 2505 AERODYNAMICS LAB - II

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 be able to samiliarize the students with :

1) A flat plate at different angles of incidence
2) Flow visualisation over cylinder at low speeds.
3) Flow visualisation over an airfoil at low speeds with various angle of incidence.
4) Calibration of supersonic wind tunnel
5) Supersonic flow visualisation with Schlieren method
6) Flow visualisation over a missile body.
7) Boundary Layer Calculation.

OUTCOME

The students should be able to understand the :

1) Flow over the flat plate at low speed.
2) Flow patterns on the cylinder.
3) Flow patterns on the airfoil with various angle of attack.
4) Methods involved in calibrating the supersonic wind tunnel.
5) Schliren method of flow visualisation
6) Flow patterns on a missile body.
7) Method for calculating the boundary layer.

LIST OF EXPERIMENTS

1.	Flow over a flat plate at different angles of incidence	6
2.	Flow visualization studies in low speed flows over cylinders	6
3.	Flow visualization studies in low speed flows over airfoil with different angle of incidence	6
4.	Calibration of supersonic wind tunnel.	6
5.	Supersonic flow visualization with Schlieren system.	9
6.	Flow visualization over missile body.	6
7.	Boundary Layer Calculation.	6

TOTAL : 45

LIST OF EQUIPMENT

Sl.No	Equipments	Qty	Experiments No.
1.	Pressure Transducers with digital display	1 No.	1,2,3,4
2.	Hele-Shaw apparatus, Smoke Tunnel, Water flow channel	1 each	1,2,3
3.	Supersonic Wind tunnel of test section size 100 x 100 mm with storage tank capacity of 500 ft 2 at 20 bar	1 No.	4,5
4.	Wooden models of cone, wedge and blunt body configurations of suitable size for flow visualization in a supersonic wind tunnel test section	1 No.	4,5
5.	Schlieren System	1 No.	4,5

SEMESTER - VI

AS 2601 PROPULSION - III

L	T	P	C
3	1	0	4

GOAL

To study in detail about fundamentals of rocket propulsion, chemical rockets, advanced propulsion systems.

OBJECTIVES

The course should enable the student :

1) To study the basics of ramjet with their performance characteristics
2) To study the solid rocket propellant and their working principles
3) To study about liquid rocket propellants and their components
4) To study the advances in rocket propulsion and space propulsion
5) To study the basics of scramjet with their performance characteristics

OUTCOME

The student should be able to know about :

1) The operating principle of ramjet, combustion and its performance.
2) The solid rocket operating principles and components of solid rocket motor.
3) In detail about liquid propellant rockets and the various types of propellants used with their burning rates.
4) About electric, ion and nuclear rockets. The basics of solar sails and its operating principle.

UNIT I RAMJET PROPULSION **13**

Operating principle - Sub critical, critical and supercritical operation - Combustion in ramjet engine - Ramjet performance - Sample ramjet design calculations - Introduction to scramjet - supersonic combustion - Numerical problems.

UNIT II SOLID PROPELLANT ROCKETS **13**

Solid propellant rockets - Selection criteria of solid propellants, hazards - Important hardware components of solid rockets - Propellant grain design considerations, combustion of solid propellants, Numerical problems.

UNIT III LIQUID PROPELLANT ROCKETS **13**

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 IV ADVANCED PROPULSION TECHNIQUES **9**

Electric rocket propulsion -Electrostatic , Electro thermal ,Electro magnetic thruster , Ion propulsion techniques - Nuclear rocket propulsion - Types , applications - Solar propulsion system, solar sail.

UNIT V SCRAMJET PROPULSION **12**

Fundamentals of hypersonic air birthing vehicles, Preliminary concepts in engine airframe integration, Various types of supersonic combustors, Requirements for supersonic combustors, Performance estimation of supersonic combustors.

TOTAL 60

TEXT BOOKS

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1993.
2. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison - Wesley Longman INC, 1999.

REFERENCES

1. Gorden, C.V., "Aero thermodynamics of Gas Turbine and Rocket Propulsion", AIAA Education Series, New York, 1989.
2. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988. Basics of scramjet engine and integral ram engine.

AS 2602 FLIGHT MECHANICS II

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 static longitudinal stability of an aircraft(stick fixed)
2) Understand static longitudinal stability of an aircraft(stick free condition)
3) Understand lateral and directional stability
4) Understand dynamic stability of an aircraft
5) Understand the helicopter flight dynamics

OUTCOME

The students should be able to get:

1) Knowledge about degrees of stability stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing. (stick fixed)

2) Knowledge about degrees of stability stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing. (stick free condition)

3) Understanding about lateral control, rolling and yawing moments, static directional stability, rudder and aileron control requirements and rudder lock

4) Understanding about dynamic longitudinal stability, stability derivatives, modes and stability criterion, lateral and directional dynamic stability

5) Understanding the rotor function in vertical flight, rotor mechanism

UNIT I STATIC LONGITUDINAL STABILITY AND CONTROL (Stick Fixed) 13

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.

UNIT II STATIC LONGITUDINAL STABILITY AND CONTROL (Stick Free) 13

Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing. Determination of neutral points and maneuver points from flight test.

UNIT III LATERAL AND DIRECTIONAL STABILITY 11

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 IV DYNAMIC STABILITY 13

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.

UNIT V HELICOPTER FLIGHT DYNAMICS 10

Rotor function in vertical flight, Rotor Mechanism for forward flight, Trim, Stability and control.

TOTAL 60

TEXT BOOKS

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, New York, 1988.

2. J.Seddon, "Basic Helicopter Aerodynamics", AIAA Series, 1990.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.

2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.

3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.

4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998

AS 2603 ADVANCED MATERIALS AND PERFORMANCE

L	T	P	C
3	0	0	3

GOAL

To understand the definition of various terms used for classification of materials. Mechanical properties, Testing of aircraft materials. Classification of alloys of aluminum, steel, titanium etc.

OBJECTIVES

The course should enable the students to :

1) Study about the various materials and alloys.
2) Study about the various smart and intelligent materials
3) Study about fatigue performance of materials
4) Study about the materials used in cryogenic temperature.
5) Study about materials at high temperature.

OUTCOME

The students should be able to get:

1) Knowledge about materials their properties, testing and classification of alloys.
2) Knowledge about piezo, pyro, and ferro electric effects and its application to aerospace vechicles.
3) Understanding about S-N curves, high and low cycle fatigue.
4) Understanding about cryogenic testing equipment, experimental program and low temperature alloys.
5) Understanding about the various materials used at high temperature like ceramic and refractory materials.

UNIT I MATERIALS AND ALLOYS **9**

Classification of materials, Mechanical properties, testing of aerospace materials, Classification of alloys - aluminum, steel, titanium, and other alloys used in aerospace.

UNIT II SMART AND INTELLIGENT MATERIALS **9**

Introduction, piezo, pyro and Ferro electric effects, hysteretic effects, fundamentals of continuum mechanics. Application to aerospace vehicles.

UNIT III FATIGUE PERFORMANCE **9**

S-N curves, endurance limits, effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams, Notches and stress concentration factors, plastic stress concentration factors, High cycle and low cycle fatigue, cumulative damage - Minor's theory.

UNIT IV MATERIALS AT CRYOGENIC TEMPERATURE **9**

Cryogenic testing equipment, Experimental program, cold worked 300 series stainless steel, aluminum alloys, titanium alloys.

UNIT V MATERIALS AT HIGH TEMPERATURE **9**

Material requirements and principles, component system analysis, structural and material analysis, material system principles, ceramic reinforced, refractory materials.

TOTAL : 45

TEXT BOOK

1. E.R.Parker, "Materials for Missiles and Spacecraft", McGraw Hill Book Co. Inc, 1978.

REFERENCES

1. Madayag, A.F., "Metal Fatigue: Theory and Design", John Wiley & Sons, Inc.1968.
2. Broutman, L. J., "Fatigue and Fracture", Vol. 5, ACADEMIC PRESS, 1974.
3. HAND BOOK OF AIRCRAFT MATERIALS, ASTM, 1983.

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 know about:

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

AS 2604 PROPULSION LAB - II

L	T	P	C
0	0	3	2

GOAL

To understand the basic concepts and carryout experiments in Aerospace Propulsion.

OBJECTIVES

The course should enable the students to :

1) Cascade testing of a model of axial compressor blade row.
2) Study of performance of propeller.
3) Determination of heat of combustion of aviation fuel using bomb calorimeter.
4) Combustion performance studies in a jet engine combustion chamber.
5) Study of free jet.
6) Study of wall jet.

OUTCOME

The students should be able to perform:

1) The techniques and methods used in cascade testing of axial compressor.
2) The performance of propeller and the parameters of propellers.
3) The methods used for finding the heat combustion value of ATF.
4) The methods used for evaluating combustion performance of combustion chamber in jet engine.
5) The methods used for determining the velocity in free jet.
6) The methods used for determining the velocity in wall jet

LIST OF EXPERIMENTS

1.	Cascade testing of a model of axial compressor blade row.	9
2.	Study of performance of a propeller.	6
3.	Determination of heat of combustion of aviation fuel.	9
4.	Combustion performance studies in a jet engine combustion chamber.	9
5.	Study of free jet.	6
6.	Study of wall jet	6
	TOTAL	**45**

LIST OF EQUIPMENTS
(For a batch of 30 students)

Sl.No	Equipments	Qty	Experiments No.
1.	Axial compressor blade row model with pressure tapping	1	1
2.	Watertube manometers (20 tubes)	2	1,5,6
3.	Subsonic wind tunnel	1	2
4.	Propeller model static and total pressure probes	4	2,5,6
5.	2-D travers in mechanism	2	1
6.	Freejet test setup	1	5
7.	Aluminium plates with deflection mechanisms	1	6

AS 2605 AERODYNAMICS DESIGN LABORATORY

L	T	P	C
0	0	3	2

GOAL

To study and design of model and measurement of Turbulence and Boundary.

OBJECTIVES

The course should enable the students to understand :

1) Calibration Technique
2) Modelling and scaling
3) Design of a model
4) Flow visualisation
5) Boundary layer & Turbulence

OUTCOME

The students should be able to learn about :

1) Different techniques used in Wind tunnel
2) Parameters related to modelling
3) Steps involved in design
4) Understanding of flows
5) Effect of Boundary and turbulences

LIST OF EXPERIMENTS

1. Simulation of Wind tunnel and calibration 6
2. Oil flow visualisation technique 9

3.	Modelling and scaling	9
4.	Design of a model and verification of pressure distribution	6
5.	Boundary layer measurement	9
6.	Turbulence effect measurement	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.	Angle of incidence changing mechanism	1 No.	3, 4
3.	Multiple Manometer stands with 20 - 30 manometer tubes	4 Nos.	2,3,4
4.	U-Tube Manometer	1 No.	1,2,3,4
5.	Static Pressure Probes	4 Nos.	1,2,3,4
6.	Total Pressure Probest	4 Nos.	1,2,3,4
7.	Pitot-Static Tubes	4 Nos.	1,2,3,4
8.	Wooden Models of Three Dimensional bodies (eg. Cylinder etc.,)	2 Nos. each	2
9.	Wind Tunnel balances (3 or 5 or 6 components)	1 No.	5
10.	Pressure Transducers with digital display	1 No.	1,2,3,4

EL 2431 COMMUNICATION SKILLS AND 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

AS 2701 FLIGHT MECHANICS III

L	T	P	C
3	1	0	4

GOAL

To study the fundamentals of space mechanics, the basic concepts of orbital mechanics with particular emphasis on satellite launching and interplanetary trajectory.

OBJECTIVES

The course should enable the students to :

1) Study the basic concepts of space mechanics.
2) Study about the N- body problem in the universe.
3) Study about satellite injection and satellite orbit perturbations.
4) Study about the various stages of ballistic missile trajectory.
5) Study about the interplanetary trajectories.

OUTCOME

The students should be able to:

1) Understand solar time solar system and associated basic terms
2) Understand satellite orbits relation between position and time.
3) Understand satellite orbit transfer, special perturbations.
4) Understand about the various phases in missile launching.
5) Understand about the spacecraft trajectories between planets.

UNIT I BASIC CONCEPTS **12**

The solar system, Reference frame and coordinate, the celestial sphere, the ecliptic , sidereal time, solar time, standard time, the earth atmosphere.

UNIT II N- BODY PROBLEM **12**

The many body problem, circular restricted three body problem, liberation points, two body problem, satellite orbits, relation between position and time, orbital elements.

UNIT III SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS **12**

Introduction to satellite injection , satellite orbit transfer, orbit deviation due to injection errors, special and general perturbations, methods of vibration of orbital elements.

UNIT IV BALLISTIC MISSILE TRAJECTORY **12**

The boost phase, the ballistic phase, trajectory geometry, optimal flights, time of flight, re-entry phase, the position of the impact point , influence coefficients.

UNIT V INTERPLANETARY TRAJECTORIES **12**

Two dimensional interplanetary trajectories, Fast interplanetary trajectories, three dimensional interplanetary trajectories, Launch of Interplanetary spacecraft, Trajectory about the target planet.

TOTAL 60

TEXT BOOK

1. Cornelisse, J.W., " Rocket propulsion and space dynamics ", W.H. Freeman & co,1984.

REFERENCE

1. Sutton, G. P., "Rocket Propulsion Elements", John Wiley, 1993
2. Van de Kamp, P., "Elements of Astromechanics", Pitman, 1979
3. Parker, E. R., "Materials for Missile and Spacecraft", McGraw-Hill Book Co. Inc., 1982.

AS 2702 INTRODUCTION TO 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 student 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) Do microscopic and macroscopic analysis
3) Analyze sandwich and laminated plates
4) Understand fabrication techniques
5) Construct and analysis different composite technique.

UNIT I STRESS STRAIN RELATION **9**

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 **15**

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 **15**

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

UNIT IV SANDWICH CONSTRUCTIONS **11**

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

UNIT V FABRICATION PROCESS **10**

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

TOTAL 60

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.

AS 2703 SATELLITES AND SPACE SYSTEM DESIGN

L	T	P	C
3	1	0	4

GOAL

To study the fundamentals of the spacecraft and satellite systems design.

OBJECTIVES

The course should enable the student to :

1) Study about the Space system design
2) Study the Space craft environment and its effects on design
3) Study the Space craft systems
4) Study the Product assurance of satellite systems and components
5) Study the Satellite engineering and applications

OUTCOME

The students should be able to :

1) Know about the Payloads and missions, system view of spacecraft propulsion system, launch vehicles, and spacecraft mechanisms
2) Know about the about Preoperational spacecraft environment, operational spacecraft environments, Environmental effects on design, the sun, the earth, and spacecraft effects, spacecraft structure and thermal control.
3) Know about the various Attitude control, Electrical power systems, Telecommunications, telemetry command, data handling and process.
4) Know about the various Failures, Reliability, material and process, safety, configuration control, build and verification, system engineering, case studies
5) Know about the Satellite design philosophy, satellite system design, COTS components in the space environment. Micro satellites, mini satellites and nano satellites, in orbit operation, satellite application for meteorology, navigation, communication, geo observation, and space environment study

UNIT I SPACE SYSTEM DESIGN **12**

Payloads and missions, system view of spacecraft propulsion system, launch vehicles, spacecraft mechanisms.

UNIT II SPCAECRAFT ENVIRONMENT AND ITS EFFECTS ON DESIGN **12**

Preoperational spacecraft environment, operational spacecraft environments, Environmental effects on design, the sun, the earth, and spacecraft effects, spacecraft structure, thermal control.

UNIT III SPACECRAFT SYSTEMS **12**

Attitude control, Electrical power systems, Telecommunications, telemetry command, data handling and process.

UNIT IV PRODUCT ASSURANCE **12**

Failures, Reliability, material and process, safety, configuration control, build and verification, system engineering, case studies

UNIT V SATELLITE ENGINEERING AND APPLICATIONS **12**

Satellite design philoshopy, satellite system design, COTS components in the space environment. Micro satellites, mini satellites and nano satellites, in orbit operation, satellite application for meteorology, navigation, communication, geo observation, and space environment study.

TOTAL 60

TEXT BOOK

1. P.Fortescue J. Stark, and G.Swinerd, "Spcaecraft systems engineering", John Wiley and sons, 2002.

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.

OBJECTIVES

The course should enable the student to:

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

OUTCOME

The students should able to understand :

1) Design Consideration of liquid Rocket Combustion Chamber.
2) Igniter Design Considerations and types of igniters.
3) Describe the drag and lift forces acting on rocket and missile.
4). The various methods of Describing Aerodynamic Forces and Moments. Lateral Damping Moment and Longitudinal Moment of a Rocket.

5. The One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields.

6. 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 describethe rocket s Separation Techniques.

7. The selection criteria for materials and Special Requirements of Materials to Perform under Adverse Conditions.

UNIT I ROCKETS SYSTEM 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 Solid Rockets.

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.

AS 2704 HIGH TEMPERATURE MATERIALS

L	T	P	C
3	0	0	3

GOAL

To learn damage mechanism and failure of components at elevated temperatures

OBJECTIVES

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 know about :

1) Creep behaviour, and effect of different factors like stress, temporary, strain rate on creep.

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

3) 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) 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) 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.

AS 2705 STRUCTURAL DESIGN LABORATORY

L	T	P	C
0	0	3	2

GOAL

To understand the structural behaviour of advanced material systems.

OBJECTIVES

The course should enable the students to understand :

1) Fabrication of Composite plate
2) Measurement of Volume fraction
3) Testing of Composite Plate (buckling test)
4) Identification of Mechanical properties (Tensile test).

OUTCOME

The students should be able to learn about :

1) Method of fabricating composites.
2) Method of measuring volume fraction of composites.
3) Method of performing buckling test in composite plate.
4) Method of performing tensile test in composite plate to get the mechanical properties.

LIST OF EXPERIMENTS

1.	Fabrication of Composite plate	12
2.	Measurement of Volume fraction	12
3.	Testing of Composite Plate (buckling test)	9
4.	Identification of Mechanical properties (Tensile test)	12
	TOTAL	**45**

LIST OF EQUIPMENT

Sl.No.	Items	Quantity	Experiment No.
1.	Universal Testing Machine	1	1,2,3,4
2.	Oven	1	1,2,3,4
3.	Fabrication Setup	1 set	1,2,3,4

AS 2706 SPACE PROPULSION LABORATORY

L	T	P	C
0	0	3	2

GOAL

To understand the advanced space propulsion system.

OBJECTIVES

The course should enable the students to learn about :

1. Preparation of propellant for rockets.
2. Identifying the burning rate of the propellant.
3. Finding the calorific value of the propellant.
4. Ignition delay measurement on rocket engine.
5. Study about water jet.
6. Testing of hybrid motor.

OUTCOME

The students should be able to appreciate and learn :

1. Method of preparing the propellants.
2. Method of identifying the burning rate of the propellant.
3. Method of finding the calorific value of the propellant.
4. Method of finding the ignition delay in rocket.
5. The principle of water jet and measuring the velocity.
6. Testing the hybrid motor.

LIST OF EXPERIMENTS

1.	Preparation of propellant	9
2.	Identification of burning rate	6
3.	Calorific value estimation	6
4.	Ignition Delay Measurement	9
5.	Water jet study	6
6.	Hybrid motor testing	9
	TOTAL	**45**

LIST OF EQUIPMENT

Sl.No.	Items	Quantity	Experiment No.
1.	Flash Point / Fire Point Apparatus	1	2
2.	Bomb Caloriemeter	1	3
3.	Free / Force Convection Apparatus	1	5
4.	Wall Jet	1	5

SEMESTER VIII
AS 2801 PROJECT & VIVA VOCE

L	T	P	C
0	0	24	6

GOAL

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

OBJECTIVES

To enable the students to work on a project involving theoretical and experimental studies related to Aerospace 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 Aerospace Engineering areas such as Aerodynamics, Propulsion & Aerospace Structures.

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)

ELECTIVES
ELECTIVES FOR SEMESTER - V

GE 2001 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 will 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, 03.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

AS 2506 AIRCRAFT MAINTENANCE PRACTICES

L	T	P	C
3	0	0	3

GOAL

To study the aircraft maintenance practices and the tools used for the same and also to understand the non destructive testing procedures.

OBJECTIVES

The course should enable the students to :

1) Know the various maintenance practices made in an aircraft.
2) Study about the various devices, tools and drawings of components.
3) Study about the various aircraft materials and corrosion types.
4) Study about the various NDT methods, welding, soldering and brazing.
5) Study about the electric cables, connectors, hoses and cables.

OUTCOME

The students should be able to learn about :

1) The maintenance practices, tools and wrenches.

2) The tools used and drawings and diagrams of nuts and bearings.

3) The various materials and corrosion control and protection.

4) The NDT methods, welding, soldering and brazing.

5) The electric cables, connectors, instruments, testing equipments and calibration methods.

UNIT I AIRCRAFT MAINTENANCE PRACTICES 9

Standard Maintenance Practices - Aircraft Maintenance Practices - General Purpose Tools - Measuring Tools - Torque Wrenches and Torque Loading Practice

UNIT II TOOLS 7

Aircraft Fastening Devices - Bolts and Screws, Nuts and Washers, Locking Devices and Springs, Engineering Drawings and Diagrams, Bearings and Gears,

UNIT III AIRCRAFT MATERIALS 11

Aircraft Materials - Ferrous, Non-Ferrous and Composite/Non-Metallic. Corrosion and Corrosion Control and Protection

UNIT IV NON-DESTRUCTIVE TESTING (NDT) AND WELDING 11

Penetrant Methods, Non-Destructive Testing Processes. Soldering, Welding and Brazing

UNIT V AIRCRAFT MISCELLANOUS 7

Electrical Cables and Connectors, Usage of Electrical Instruments and Equipment, Testing and Calibration Methods, Pipes, Hoses and Control Cables, Aircraft Weight and Balance Control,Quality System and Procedures.

TOTAL 45

REFERENCES:

1. Civil Aircraft Inspection Procedures (CAP 459-Part I, Basic)
2. Airframe & Powerplant Mechanics (General Handbook EA-AC 65-9A)
3. James Anderson Earl E. Tatro , "Shop Theory"
4. Dale Crane, "Training Manual General Section Book 1 thru 7"
5. Titterton , "Aircraft Materials & Processes"
6. AC Parkinsons, "Machine Drawing"
7. Cindy Foreman, "Advanced Composites (EA-358)"
8. Malvino and Leech , "Digital Fundamentals"
9. Standard Aviation Maintenance Handbook EA-282-0
10. Larry Reithmaier , "Standard Aircraft Handbook (5th Edition)"

AS 2507 AERO ELASTICITY

L	T	P	C
3	0	0	3

GOAL

To study the effects of aero elasticity and wind tunnel testing, also to give a basic introduction to MATLAB.

OBJECTIVES

1) To understand the aero elasticity phenomena and its related functions.
2) To understand the systems having single degrees of freedom.
3) To understand the theories regarding multiple degrees of freedom.
4) To understand the static problem of aero elasticity of various practical devices.
5) To understand the basics of MATLAB and its applications.

OUTCOME

1) The learner will able to understand the phenomenon of aero elasticity.
2) The learner will able to solve problem related to single degrees of freedom
3) The learner will able to solve problems using the theorems of multiple degrees of freedom.
4) The learner will able to solve problems by analysing the systems which undergo static aero elasticity problems.
5) The learner will able to solve problems in aero elasticity using MATLAB.

UNIT I INTRODUCTION **9**

Aero elasticity phenomena, flutter, divergence, control reversal, flexibility effects on stability and control.

UNIT II SINGLE DEGREE OF FREEDOM **9**

Introduction to degrees of freedom , Response of single degree of freedom, system, Laplace transform, Harmonic excitation virtual work, lagrange's equation.

UNIT III MULTIPLE DEGREES OF FREEDOM **9**

Classical theories of multi degree freedom system, Undamped mode and frequencies.

UNIT IV STATIC AEROELASTICIY **9**

Static problem, divergence of wind tunnel models, wall - sting and strut - mounted models, control reversal, classical flutter analysis, one and two - degree of freedom flutter, flutter boundary characteristics.

UNIT V MAT LAB **9**

Introduction to Mat Lab, application of mat lab for solving aero elastic problem. Design of spline mat lab coading.

TOTAL 45

TEXT BOOK

1. Y.C. Fung, " An Introduction to the Theory of Aero elasticity (2002) ", John wiley &Sons,.

AS 2508 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 PHOTO ELASTICITY **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 BOOKS

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.

ELECTIVES FOR SEMESTER - VI

AS 2606 ADVANCED STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

GOAL

To analyse the stresses and deformations through advanced mathematical models, and to estimate the design strength of various industrial equipments.

OBJECTIVES

The course should enable the student to:

1) Study about the analysis of plates with different loads.
2) Study about the analysis of thick cylinders and spheres with applied stress.
3) Study about the analysis of rotating discs with various theorems.
4) Study about the beams with different kinds of loads.
5) Study about the curved beams and clamps with load applied.

OUTCOME

The course should enable the student to:

1) Understand various methods for analysing the plates with various stresses and designs.
2) Understand the methods of solving problems related to different cylinders and spheres.

3) Understand the theorems for analysing the rotating discs.

4) Understanding the problems solving beams with different kinds of loads.

5) Understanding the problem related to beams with large curvature.

UNIT I ANALYSIS OF PLATES 8

Mathematical modeling of plates with normal loads - Point and Distributed Loads - Support conditions - Rectangular plates - Stresses along coordinate axes - Plate deformations - Axi-symmetric plates - Radial and tangential stresses - plate deflections.

UNIT II THICK CYLINDERS AND SPHERES 10

Equilibrium and compatibility conditions - Lame's Theorem - Boundary conditions - distribution of radial and tangential stresses - compound cylinders - Interference fits - Stresses due to temperature distributions.

UNIT III ROTATING DISCS 10

Lame-Clayperon Theorem - radial and tangential stresses in discs due to centrifugal effects - boundary conditions - solid and hollow discs - Interference fit on shafts -Strengthening of the hub - residual stresses - Autofrettege - Discs of variable thickness - Disc profile for uniform strength.

UNIT IV BEAMS ON ELASTIC FOUNDATION 8

Infinite beam subjected to concentrated load - Boundary Conditions - Infinite beam subjected to a distributed load segment - Triangular load - Semi infinite beam subjected to loads at the ends and concentrated load near the ends - Short beams.

UNIT V CURVED BEAMS AND CONTACT STRESSES 9

Analysis of stresses in beams with large curvature - Stress distribution in curved beams - Stresses in crane hooks and C clamps - Contact Stresses - Hertz equation for contact stresses - applications to rolling contact elements.

TOTAL 45

TEXT BOOKS

1. Boresi A.P., Schmidt R.J., "Advanced Mechanics of Materials", John Wiley and Sons, Sixth edition, 2003.

2. Dally J.W. and Riley W.F, "Experimental Stress Analysis", John Wiley and Sons 2003

REFERENCES

1. Burr A. H., CheathAm J.B., "Mechanical Analysis and Design", Prentice Hall of India, Second edition, 2001.

2. Den-Hartog J.P., "Strength of Materials", John Wiley and Sons.

AS 2607 FEM IN AEROSPACE

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, 1985.

AS 2608 THEORY OF COMBUSTION

L	T	P	C
3	0	0	3

GOAL

To study the different processes in combustion, difficulties faced and the methods to overcome them.

OBJECTIVES

The course should enable the students :

1) To understand the basic principles of combustion and its characteristics.
2) To understand the dynamics of combustion and methods for modelling the combustion.
3) To understand the reduced kinetic schemes in combustion.
4) To understand the process of combustion instability.
5) To understand the process of combustion diagnostics.

OUTCOME

The students should be able to :

1) Understand the combustion chemistry and its characteristics.
2) Learn about the problem related to the combustion process and its simulation.
3) Learn about the H-O, H-C flame and propellant deflagration.
4) Learn about the Theory of instability and analysis of instabilities.
5) Learn about the various combustion diagnostics like absorption, fluorescence etc.

UNIT I INTRODUCTION **9**

Combustion chemistry, Droplet combustion, reduced kinetic schemes, Combustion instability, Combustion enhancement, Modeling and simulation, Combustion diagnostics.

UNIT II CHEMISTRY AND DYNAMICS **9**

Experimental and theoretical methods, Matrix isolation, Computational chemistry methods, Determination of strain energies and heat of formation of model compound, Determination of the chemical mechanism of strain energy.

UNIT III REDUCED KINETIC SCHEMES IN COMBUSTION **9**

Different approach, Hydrogen-Oxygen and hydrocarbon flame, Propellant deflagration.

UNIT IV COMBUSTION INSTABILITY **9**

Types of instability, Theoretical analysis, Numerical simulation, Experimental studies.

UNIT V COMBUSTION DIAGNOSTICS **9**

Nonresonant techniques, Absorption, Fluorescence, Algebraic turbulence, Closures for two-phase flows, Stochastic modeling.

TOTAL 45

TEXT BOOK

1. G.D.Roy,"Propulsion Combustion", Taylor & Francis, 1997

REFERENCE

1. N.Kuboto, "Propellants and Explosives", Wiley-VCH Verkeg Gmbh & co KGOA, 2007.

ELECTIVES FOR SEMESTER - VII

AE 2751 WIND TUNNEL TECHNIQUES

L	T	P	C
3	0	0	3

GOAL

Wind tunnel techniques course depicts the types,workingand 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 Non-dimensional 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) Can clearly understand the working of Blow down,Indraft tunnels and their specifications
3) Horizontal buoyancy, Flow angularities are checked while calibration
4) Component axis balance and internal balances are read and understood for the measurements in wind tunnel
5) Can get a clear idea about the smoke and tuft flow visualisation procedures in Wind Tunnel 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

AS 2708 DESIGN OF GAS TURBINES

L	T	P	C
3	0	0	3

PRE REQUISITE

PROPULSION - I, II & III

GOAL

To study the aircraft gas turbines and their design, cycle analysis of ideal and real engine.

OBJECTIVES

The course should enable the students to :

1) Study about the Elements of propulsion
2) Study the Aircraft gas turbine engine
3) Study the Component performance and engine performance analysis
4) Study the Cycle analysis of ideal engine
5) Study the Parametric cycle analysis of real engine

OUTCOME

The students should be able to :

1) Know about the Propulsion and thrust, Operational envelope, Types of air breathing engines and parameters of aircraft performance.
2) Know about the Gas turbine engine components, Brayton cycle, Aircraft design, Parametric cycle analysis, Eulers's turbo machinery equation, Axial and centrifugal system.
3) Know about the Variation in gas properties, Component performance, Inlet and diffuser function, Compressor and turbine efficiency, Burner, Exhaust, Nozzle, Mechanical efficiency, Component performance, Turbo engine, Turbo engine with after burner and turbo engine with separate exhaust and convergent nozzle.

4) Know about the Design input, Steps of engine parameter analysis, Ideal cases of Ramjet, Turbojet, Turbofan, Turbojet with afterburner, Turbofan with optimum bypass ratio, Turbofan with optimum fan pressure ratio, Ideal pulse detonation engine.

5) Know about the Turbojet, Turbojet with afterburner, Turbofan repeated exhaust stream, Blade and material approach, Nozzle design.

UNIT I ELEMENTS OF PROPULSION 9

Propulsion and thrust, Operational envelope, Types of air breathing engines and parameters of aircraft performance.

UNIT II AIRCRAFT GAS TURBINE ENGINE 9

Gas turbine engine components, Brayton cycle, Aircraft design, Parametric cycle analysis, Eulers's turbo machinery equation, Axil and centrifugal system.

UNIT III COMPONENT PERFORMANCE AND ENGINE PERFORMANCE ANALYSIS 9

Variation in gas properties, Component performance, Inlet and diffuser function, Compressor and turbine efficiency, Burner, Exhaust, Nozzle, Mechanical efficiency, Component performance, Turbo engine, Turbo engine with after burner and turbo engine with separate exhaust and convergent nozzle.

UNIT IV CYCLE ANALYSIS OF IDEAL ENGINE 9

Design input, Steps of engine parameter analysis, Ideal cases of Ramjet, Turbojet, Turbofan, Turbojet with afterburner, Turbofan with optimum bypass ratio, Turbofan with optimum fan pressure ratio, Ideal pulse detonation engine.

UNIT V PARAMETRIC CYCLE ANALYSIS OF REAL ENGINE 9

Turbojet, Turbojet with afterburner, Turbofan repeated exhaust stream, Blade and material approach, Nozzle design.

TOTAL 45

TEXTBOOK:

1. J.D.Mattingly, and H.V.Oha, "Elements of propulsion: Gas Turbines and Rockets", AIAA Ed. Series, 2006.

REFERENCES:

1. W.J. Hesse and N.V.S Mumford (Jr), "Jet propulsion for aerospace applications", Pitman Pub. Co, New York, 1974.

2. P.G.Hill & C.R. Peterson, 'Mechanics of Thermodynamics of Propulsion', AWA Longman, Inc 1999.

AS 2707 INTRODUCTION TO NDT

L	T	P	C
3	0	0	3

GOAL

To study the various process involved in non destructive testing.

OBJECTIVES

The course should enable the students to :

1) Study the basics of NDT, its history and applications.
2) Study the process of various visual testing techniques used in NDT.
3) Study the process of radiographic testing and its applications.
4) Study the process of ultrasonic testing and its applications.
5) Study the other methods used in NDT technique.

OUTCOME

The students should be able to:

1) Understand the background of NDT and its applications.
2) Understand the different methods of visual testing and their advantages.
3) Understand the technique of radiographic testing and its equipments.
4) Understand the technique of ultrasonic testing and its equipments
5) Understand other different method used in NDT.

UNIT I INTRODUCTION **8**

Introduction to NDT, concern in NDT, History, NDT vs. Destructive, Conditions for NDT, Personal Considerations, Certification, Primary production of metal, castings, cracks, welding discontinuities, corrosion induced discontinuities, fatigue cracking, creep, brittle fracture, geometric discontinues.

UNIT II VISUAL TESTING **10**

History and Development, Theory and Principles, Equipment and Accessories, Applications and Techniques, Evaluation of Test Results, Advantages and Limitations, Penetrate Testing- Introduction, History and Development, Theory and Principles, Penetrate Equipment and Materials, Penetrant Procedures, Techniques and Variables, Evaluation and Disposition, Penetrate Testing Applications, Quality Control Considerations, Advantages and Limitations, Glossary of Penetrate Testing Terms, Magnetic Particle Testing - History and Development, Theory and Principles, Equipment and Accessories, Techniques, Variables, Evaluation of Test Results and Reporting, Applications, Advantages and Limitations.

UNIT III RADIOGRAPHIC TEST **10**

History and Development, Theory and Principles, Radiographic Equipment and Accessories, Variables, Techniques and Procedures, Radiographic Evaluation, Applications, Advantages and Limitations of Radiography, Compendium of Radiographs

UNIT IV ULTRASONIC TESTING **10**

History, Theory and Principles, Equipment for Ultrasonic Applications, Techniques, Variables, Evaluation of Test Results, Applications, Advantages and Limitations, Eddy Current Testing- History and Development, Theory and Principles, Alternating Current Principles, Eddy Currents, Test Equipment, Eddy Current Applications and Signal Display, Advantages and Limitations, Other Electromagnetic Test Techniques

UNIT V OTHER METHODS **7**

Thermal Infrared Testing - History and Development, Theory and Principles, Equipment and Accessories, Techniques, Variables, Data Storage, Applications, Advantages and Limitations, Acoustic Emission Testing - History and Development, Principles of Acoustic Emission Testing, Advantages and Limitations of Acoustic Emission Testing.

TOTAL 45

TEXT BOOK:

1. P. E. Mix, "Introduction to non-destructive testing", Wiley Interscience,, John Wiley & Sons, Inc, Publ., 2005

REFERENCE:

1. C. Hellier, "Handbook of Nondestructive Evaluation", McGraw-Hill, 1994.

ELECTIVES FOR 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 subject 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) 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 for Hyperbolic 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 Discretizations - Treatment of Derivatives.

TOTAL 45

TEXT BOOK

1. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1988.

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, 1988.
3. Klaus A Hoffmann and Steve T. Chiang. "Computational Fluid Dynamics for Engineers", Vols. I & II Engineering Education System, P.O. Box 20078, W. Wichita, K.S., 67208 - 1078 USA, 1993.
4. Anderson, Jr.D., "Fundamentals of Aerodynamics", McGraw-Hill, 2000.

AS 2802 FUNDAMENTALS OF SPACE VEHICLE DESIGN

L	T	P	C
3	0	0	3

GOAL

To study the fundamentals of space vehicle, spacecraft configuration, spacecraft design management.

OBJECTIVES

The course should enable the students to :

1) Understand Space Mission analysis and Design process
2) Impart spacecraft configuration and structural design
3) Gain knowledge on thermal control on space craft
4) Understand space craft attitude, control and instrumentation
5) Understand space craft design management

OUTCOME

The students should be able to know about :

1) Mission objectives, needs, requirements and constraints, logistics
2) Design requirements, process, analysis and verification with future space structure
3) Thermal design, balance and analysis of satellite
4) Basic launch vehicle consideration,selection process, spacecraft design envelope, Attitude requirements, Space control system, Navigation & Telecommunication, Onboard systems, Science instruments

5. Vehicle design and mission concept, System engineering, Product assurance, Spacecraft integration and test, reliability and quality assurance, Small satellite engineering and application and its costing system.

UNIT I SPACE MISSION ANALYSIS AND DESIGN PROCESS **9**

Space mission life cycle, Mission objectives, Mission needs, Mission requirements and constraints, Space environment and survivability, Space logistics and reliability, Orbital debris

UNIT II SPACECRAFT CONFIGURATION AND STRUCTURAL DESIGN **9**

Design requirements, Design process, Material solution, Analysis, Design verification, Impact protection, Configuration, The future of space structure.

UNIT III THERMAL CONTROL OF SPACECRAFT **9**

Thermal environment, Thermal balance, Thermal analysis, Thermal design, Thermal technology, Thermal design verification, Satellite thermal design.

UNIT IV SPACECRAFT ATTITUDE, CONTROL AND INSTRUMENTATION **9**

Basic launch vehicle consideration, Launch system selection process, Determining the spacecraft design envelope, Attitude requirements, kinematics, measurements, estimation and dynamics, Space control system, Telecommunication, Onboard systems, Science instruments, Navigation.

UNIT V SPACECRAFT DESIGN MANAGEMENT **9**

Vehicle design and mission concept, System engineering, Product assurance, Spacecraft integration and test, Spacecraft reliability and quality assurance, Small satellite engineering and application, Cost.

TOTAL 45

TEXT BOOK

1. V.L. Pisacane and R.C. Moore, "Fundamentals of Space Systems", AIAA Series, 2003

REFERENCES:

1. P. Fortescue, J. stark, and G. Swinerd, " Spacecraft Systems Engineering" AIAA Series, 2005
2. W.J. Larson and J. R. Wertz., "Space Mission Analysis and design", AIAA Series, 1998
3. M.J.L. Turner, "Rocket and Spacecraft Propulsion" (Principles, Practice and New Developments).

AS 2803 CRYOGENIC PROPULSION

L	T	P	C
3	0	0	3

GOAL

To study the engineering concept of cryogenic and its application in various field.

OBJECTIVES

The course should enable the students to :

1) Study the basics of cryogenic technology and its applications.
2) Study the different properties of cryogenic materials and their process.
3) Study the technique of cryogenic insulation.
4) Study the different methods for storing the cryogenics and instruments used in cryogenics.
5) Study the different cryogenic equipments used for various process.

OUTCOME

The students should be able to :

1) Understand the background of cryogenic technology and its applications.
2) Understand the properties of cryogenic materials and their production.
3) Understand the different methods used for cryogenic insulation.
4) Understand the technique for storing cryogenics.
5) Understand the different cryogenic equipments and theri applications.

UNIT I INTRODUCTION TO CRYOGENIC ENGINEERING **10**

Thermo physical and fluid dynamic properties of liquid and gas hydrogen, Thermo physical and fluid dynamic properties of liquid and gas helium, Liquefaction systems of hydrogen and helium gases, Liquefaction systems of hydrogen and helium gases, Refrigeration and liquefaction principals; Joule Thomson effect and inversion curve; Adiabatic and isenthalpic expansion with their comparison

UNIT II PROPERTIES **10**

Cryogenic fluids, Solids at cryogenic temperatures; Superconductivity, Recuperative - Linde - Hampson, Claude, Cascade, Heylandt, Kapitza, Collins, Simon; Regenerative - Stirling cycle and refrigerator, Slovay refrigerator, Gifford-McMahon refrigerator, Vuilleumier refrigerator, Pulse Tube refrigerator; Liquefaction of natural gas

UNIT III CRYOGENIC INSULATION **6**

Vacuum insulation, Evacuated porous insulation, Gas filled Powders and fibrous materials, Solid foams, Multilayer insulation, Liquid and vapour Shields, Composite insulations.

UNIT IV STORAGE AND INSTRUMENTATION OF CRYOGENIC LIQUIDS **9**

Design considerations of storage vessel; Dewar vessels; Industrial storage vessels; Storage of cryogenic fluids in space; Transfer systems and Lines for cryogenic liquids; Cryogenic valves in transfer lines; Two phase flow in Transfer system; Cool-down of storage and transfer systems, Measurement of strain, pressure, flow, liquid level and Temperature in cryogenic environment; Cryostats.

UNIT V CRYOGENIC EQUIPMENT **10**

Cryogenic heat exchangers - recuperative and regenerative; Variables affecting heat exchanger and system performance; Cryogenic compressors, Pumps, expanders; Turbo alternators; Effect of component inefficiencies; System Optimization, Magneto-caloric refrigerator; 3He-4He Dilution refrigerator; Cryopumping; Cryogenic Engineering applications in energy, aeronautics, space, industry, biology, preservation Application of Cryogenic Engineering in Transport.

TOTAL 45

TEXT BOOK

1. T.M. Flynn, Marcel Dekker., Cryogenic Engineering,

REFERENCES

1. A. Bose and P. Sengupta, "Cryogenics: Applications and Progress", Tata McGraw Hill.
2. J.G. Weisend II, Taylor and Francis , "Handbook of Cryogenic Engineering",
3. R.Barron,"Cryogenic Systems", Oxford University Press.
4. K.D.Timmerhaus and T.M. Flynn, "Cryogenic Process Engineering", Plenum Press.
5. G.G.Haselden,"CryogenicFundamentals", AcademicPress.
6. C.A.Bailey,"AdvancedCryogenics",PlenumPress.
7. R.W. Vance and W.M. Duke , "Applied Cryogenic Engineering", John Wiley & sons.