ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABUS

AERONAUTICAL ENGINEERING

For

B.TECH. FOUR YEAR DEGREE COURSE

(Aplicable for the batches admitted from 2010-2011)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
KUKATPALLY, HYDERABAD – 500 085.

Academic Regulations 2009 for B. Tech (Regular)

(Effective for the students admitted into I year Mining Machinery from the Academic Year 2009-2010 onwards)

1. Award of B.Tech. Degree

A student will be declared eligible for the award of the B. Tech. Degree if he fulfils the following academic regulations:

i. **Pursued a course of study for not less than four academic years and not more than eight academic years.**

ii. **Register for 200 credits and secure 200 credits**

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech course.

3. Courses of study

The following courses of study are offered at present for specialization for the B. Tech. Course:

Branch Code	Branch
I.	Aeronautical Engineering.
II.	Automobile Engineering.
III.	Bio-Medical Engineering.
IV.	Biotechnology.
V.	Chemical Engineering.
VI.	Civil Engineering.
VII.	Computer Science and Engineering.
VIII.	Electrical and Electronics Engineering.
IX.	Electronics and Communication Engineering.
X.	Electronics and Computer Engineering.
XI.	Electronics and Instrumentation Engineering.
XII.	Electronics and Telematics Engineering.
XIII.	Information Technology.
XIV.	Instrumentation and Control Engineering.
XV.	Mechanical Engineering (Mechatronics).

XVI.	Mechanical Engineering (Production).
XVII.	Mechanical Engineering.
XVIII.	Metallurgy and Material Technology.
XIX.	Mining Engineering
XX.	Mining Machinery

and any other course as approved by the authorities of the University from time to time.

4. Credits

	I Year		Semester	
	Periods / Week	Credits	Periods / Week	Credits
Theory	03	06	03	03
	02	04	—	—
Practical	03	04	03	02
Drawing (Eng. Drawing/ Machine Drawing & Computer aided graphics	02T/03D	04	03 06 05	02 04 03
Mini Project	—	—	—	02
Comprehensive Viva Voce	—	—	—	02
Seminar	—	—	6	02
Project	—	—	15	10

5. Distribution and Weightage of Marks

i. The performance of a student in each semester / 1 year shall be evaluated subject–wise with a maximum of 100 marks for theory and 75 marks for practical subject. In addition, Industry oriented mini-project, seminar and project work shall be evaluated for 50, 50 and 200 marks respectively.

ii. For theory subjects the distribution shall be 25 marks for Internal Evaluation and 75 marks for the End-Examination.

iii. For theory subjects, during the semester there shall be 2 mid term examinations. Each mid term examination consists of one objective

paper, one subjective paper and one assignment. The objective paper is for 10 marks and subjective paper is for 10 marks, with a duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for subjective paper). Objective paper is set for 20 bits of – multiple choice questions, fill-in the blanks, matching type questions – for the 10 marks. Subjective paper of each semester shall contain 4 full questions (one from each unit) of which, the student has to answer 2 questions, each carrying 5 marks.

First mid term examination shall be conducted for 1-4 units of syllabus and second mid term examination shall be conducted for 5-8 units. 5 marks are allocated for Assignments (as specified by the concerned subject teacher) – first Assignment should be submitted before the conduct of the first mid, and the second Assignment should be submitted before the conduct of the second mid. The total marks secured by the student in each mid term examination are evaluated for 25 marks, and the better of the two mid term examinations shall be taken as the final marks secured by each candidate.

However, for first year, there shall be 3 mid term examinations (each for 25 marks), along with 3 assignments in a similar pattern as above [1st mid shall be from 1-2 units, 2nd mid from 3-5 units and 3rd mid shall be from 6-8 units], and the average marks of the best two examinations secured (each evaluated for a total of 25 marks) in each subject shall be considered as final marks for the internals / sessionals.

iv. For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 50 end examination marks. Out of the 25 marks for internal, day-to-day work in the laboratory shall be evaluated for 15 marks and internal examination for practical shall be evaluated for 10 marks conducted by the concerned laboratory teacher. The end examination shall be conducted with external-examiner and laboratory teacher. The external examiner shall be appointed from the cluster of colleges as decided by the University examination branch.

v. For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 25 marks for internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for end examination. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal

tests. However in the I year class, there shall be three tests and the average of best two will be taken into consideration.

vi. There shall two training program schedules (Industrial Training) of 30 days each, one in the summer period between II & III years and the other in the summer period between III & IV years. The first training programme shall be evaluated in III year I Semester for 25 marks, and the second training programme shall be evaluated in IV year I Semester for 25 marks, based on the two individual training reports submitted by each student. The total shall be evaluated for 50 marks with a weightage of 2 credits and the same shall be posted in the IV year II Semester marks sheet of the student. The Training Report Evaluation Committee consists of an external examiner, head of the department, the supervisor of Training Programme and a senior faculty member of the department. There shall be no internal marks for industry training.

vii. There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

vii. There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of (i) Head of the Department (ii) two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects he / she studied during the B.Tech course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-voce.

ix. Out of a total of 200 marks for the project work, 50 marks shall be for Internal Evaluation and 150 marks for the End Semester Examination. The End Semester Examination (viva-voce) shall be conducted by the same committee appointed for industry oriented mini project. In addition the project supervisor shall also be included in the committee. The topics for industry oriented mini project, seminar and project work shall be different from each other. The evaluation of project work shall

be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project.

x. **Laboratory marks and the sessional marks awarded by the College are not final. They are subject to scrutiny and scaling by the University wherever necessary. In such cases, the sessional and laboratory marks awarded by the College will be referred to a Committee.** The Committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same is asked for.

6. Attendance Requirements:

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

ii. **Shortage of Attendance below 65% in aggregate shall in NO case be condoned.**

iii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or I year may be granted by the College Academic Committee.

iv. A student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester / I year, as applicable. They may seek re-admission for that semester / I year when offered next.

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

vi. A stipulated fee shall be payable towards condonation of shortage of attendance.

7. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

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

ii. A student shall be promoted from II to III year only if he fulfils the academic requirement **of 37** credits from one regular and one supplementary examinations of I year, and one regular examination of II year I semester irrespective of whether the candidate takes the examination or not.

iii. A student shall be promoted from third year to fourth year only if he fulfils the academic requirements of total **62** credits from the following examinations, whether the candidate takes the examinations or not.

a. Two regular and two supplementary examinations of I year.

b. Two regular and one supplementary examinations of II year I semester.

c. One regular and one supplementary examinations of II year II semester.

d. One regular examination of III year I semester.

iv. A student shall register and put up minimum attendance in all 200 credits and earn the 200 credits. Marks obtained in all 200 credits shall be considered for the calculation of percentage of marks.

v. Students who fail to earn 200 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech course and their admission shall stand cancelled.

8. Course pattern:

i. The entire course of study is of four academic years. The first year shall be on yearly pattern and the second, third and fourth years on semester pattern.

ii. A student eligible to appear for the end examination in a subject, but absent at it or has failed in the end examination may appear for that subject at the supplementary examination.

iii. When a student is detained due to lack of credits / shortage of attendance he may be re-admitted when the semester / year is offered after fulfilment of academic regulations, whereas the academic regulations hold good with the regulations he was first admitted.

9. Award of Class:

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

Class Awarded	% of marks to be secured	From the aggregate marks secured for the best 200
First Class with Distinction	70% and above	
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

10. Minimum Instruction Days:

The minimum instruction days for each semester / I year shall be 90/ 180 clear instruction days.

11. There shall be no branch transfers after the completion of admission process.

12. There shall be no place transfer within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Hyderabad.

13. General:

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

ii. The academic regulation should be read as a whole for the purpose of any interpretation.

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

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

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Academic Regulations for B. Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2009-2010 and onwards)

1. The Students have to acquire 150 credits from II to IV year of B.Tech. Program (Regular) for the award of the degree.
Register for **150** credits and secure **150** credits.

2. Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

3. The same attendance regulations are to be adopted as that of B. Tech. (Regular).

4. Promotion Rule:

A student shall be promoted from third year to fourth year only if he fulfils the academic requirements of 37 credits from the examinations.

a. Two regular and one supplementary examinations of II year I semester.

b. One regular and one supplementary examinations of II year II semester.

c. One regular examination of III year I semester.

5. Award of Class:

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

First Class with Distinction	70% and above	From the aggregate marks secured for 150 Credits. (i.e. II year to IV year)
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

6. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining

	hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	examinations of the subjects of that semester/ year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations

		in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.

10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show cause notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITYHYDERABAD
B.TECH. AERONAUTICAL ENGINEERING
I YEAR COURSE STRUCTURE

Code	Subject	L	T/P/D	C
51001	English	2	-	4
51002	Mathematics - I	3	1	6
51003	Engineering Mechanics	3	1	6
51004	Engineering Physics	2	1	4
51005	Engineering Chemistry	2	-	4
51006	Computer Programming & Data Structures	3	-	6
51007	Engineering Drawing	2	3	4
51656	Computer Programming Lab.	-	3	4
51657	Engineering Physics / Engineering Chemistry Lab	-	3	4
51658	English Language Communication Skills Lab.	-	3	4
51659	Engineering Workshop / IT Workshop	-	3	4
	Total	**17**	**18**	**50**

II YEAR I SEMESTER COURSE STRUCTURE

Code	Subject	L	T/P/D	C
53001	Mathematics-II	4	1	4
53017	Thermodynamics	4	1	4
53016	Mechanics of Solids	3	1	3
53043	Mechanics of Fluids	4	1	4
53044	Introduction of Aerospace Engg	3	1	3
53013	Environmental Studies	3	-	3
53628	Aircraft Engineering Drawing Lab	-	3	2
53629	Mechanics of Solids and Mechanics of Fluids Lab	-	3	2
	Total	**21**	**11**	**25**

II YEAR II SEMESTER COURSE STRUCTURE

Code	Subject	L	T/P/D	C
54040	Aerodynamics-I	4	1	4
54041	Aircraft Production Technology	3	1	4
54042	Electrical and Electronics Engineering	4	-	4
54043	Aerospace Vehicle Structures -I	3	1	3
54044	Introduction Space Technology	3	1	3
54045	Flight Mechanics –I	4	1	4
54632	Aircraft Production Technology Lab	-	3	2
54633	Electrical and Electronics Engineering Lab	-	3	2
	Total	**21**	**11**	**25**

III YEAR I SEMESTER COURSE STRUCTURE

Code	Subject	L	T/P/D	C
55010	Management Science	3	1	3
55067	Flight Mechanics- II	4	1	4
55068	Aerodynamics– II	4	1	4
55069	Aerospace Vehicle Structures– II	3	1	3
55070	Aerospace Propulsion- I	4	1	4
55071	Air Transportation Systems	3	1	3
55629	Aerospace Structures Lab	0	3	2
55630	Aerodynamics and Propulsion Lab	0	3	2
	Total	**21**	**11**	**25**

III YEAR II SEMESTER COURSE STRUCTURE

Code	Subject	L	T/P/D	C
56070	Computational aerodynamics	3	1	3
56071	Conceptual Design of Flight Vehicles	4	1	4
56072	Aerospace Propulsion- II	4	1	4
56073	Aircraft Systems	3	1	3
56074	Finite Element Methods	4	1	4
	Open Elective	3	1	3
56014	Nanotechnology			
56066	Probability & Statistics			
56021	Engineering Optimization			
56634	Advanced English Communication Skills Lab	0	3	2
56635	Flight Vehicle Design Lab	0	3	2
	Total	**21**	**11**	**25**

IV YEAR I SEMESTER COURSE STRUCTURE

Code	Subject	L	T/P/D	C
57114	Airframe Structural Design	4	1	4
57115	Mechanical Vibrations and Structural Dynamics	4	1	4
57024	CAD/CAM	4	1	4
57116	Control Theory – Application to Flight Control Systems	3	1	3
	Elective – I	3	1	3
57117	Advanced Computational Aerodynamics			
57118	Flight Scheduling and Operations			
57119	Mechanisms and Mechanical Design			
57120	Theory of Elasticity			

	Elective - II	3	1	3
57121	Space Mechanics			
57122	Experimental Aerodynamics			
57123	Numerical Methods			
57124	Aircraft Maintenance Engineering			
57629	Computational Structures Lab	0	3	2
57630	Computational Aerodynamics Lab	0	3	2
	Total	**21**	**11**	**25**

IV YEAR II SEMESTER COURSE STRUCTURE

Code	Subject	L	T/P/D	C
58089	Avionics & Instrument Systems	3	0	3
	Elective –III	3	1	3
58090	Airport Planning and Operations			
58091	Analysis of Composite Structures			
58092	Helicopter Engineering			
58093	Hypersonic Aerodynamics			
	Elective – IV	3	1	3
58094	Heat Transfer			
58095	Launch Vehicle and Missile Technology			
58096	Wind Engineering and Industrial Aerodynamics			
58097	Aeroelasticity			
58657	Industry Oriented Mini Project	0	0	2
58658	Seminar	0	6	2
58659	Project Work	0	15	10
58660	Comprehensive Viva	0	0	2
	Total	**9**	**23**	**25**

Note : All End Examinations (Theory and Practical) are of three hours duration.

T-Tutorial **L – Theory**

P – Practical/Drawing **C – Credits**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. AE.	**L**	**T/P/D**	**C**
	2	**-/-/-**	**4**

(51001) ENGLISH

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure by the students. Hence, it is suggested that they read it on their own with topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section , as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. *However, the stress in this syllabus is on skill development and practice of language skills.*

2. OBJECTIVES:

a. To improve the language proficiency of the students in English with emphasis on LSRW skills.

b. To equip the students to study academic subjects with greater facility through the theoretical and practical components of the English syllabus.

c. To develop the study skills and communication skills in formal and informal situations.

3. SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation

2. To equip students with necessary training in listening so that can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.

2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from all the nine units of the prescribed text: *Learning English: A Communicative Approach.*)
- Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.

2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.
   - Skimming the text
   - Understanding the gist of an argument
   - Identifying the topic sentence
   - Inferring lexical and contextual meaning
   - Understanding discourse features
   - Recognizing coherence/sequencing of sentences

NOTE: *The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from the non-detailed text or other authentic texts, such as magazines/newspaper articles.*

Writing Skills :

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.
   - Writing sentences
   - Use of appropriate vocabulary
   - Paragraph writing
   - Coherence and cohesiveness
   - Narration / description
   - Note Making
   - Formal and informal letter writing
   - Editing a passage

4. TEXTBOOKS PRESCRIBED:

In order to improve the proficiency of the student in the acquisition of the

four skills mentioned above, the following texts and course content, divided into **Eight Units**, are prescribed:

For Detailed study

1. **First Text book entitled "Enjoying Everyday English", Published by Sangam Books, Hyderabad**

For Non-detailed study

1. **Second text book "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur**

A. STUDY MATERIAL:

Unit –I

1. **Chapter entitled *Heaven's Gate* from "Enjoying Everyday English", Published by Sangam Books, Hyderabad**
2. **Chapter entitled *Haragovind Khorana* from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur**

Unit –II

1. **Chapter entitled *Sir CV Raman: A Pathbreaker in the Saga of Indian Science* from "Enjoying Everyday English", Published by Sangam Books, Hyderabad**
2. **Chapter entitled *Sam Petroda* from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur**

Unit –III

1. **Chapter entitled *The Connoisseur* from "Enjoying Everyday English", Published by Sangam Books, Hyderabad**
2. **Chapter entitled *Mother Teresa* from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur**

Unit –IV

1. **Chapter entitled *The Cuddalore Experience* from "Enjoying Everyday English", Published by Sangam Books, Hyderabad**
2. **Chapter entitled *Dr Amartya Kumar Sen* from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur**

Unit –V

1. **Chapter entitled *Bubbling Well Road* from "Enjoying Everyday**

English", Published by Sangam Books, Hyderabad

2. **Chapter entitled *I Have a Dream* by Martin Luther King from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur**

Unit – VI

1. **Chapter entitled *Odds Against Us* from "Enjoying Everyday English", Published by Sangam Books, Hyderabad**

2. **Chapter entitled *Ask Not What Your Country can do for you* by John F Kennedy from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur**

* Exercises from the lessons not prescribed shall also be used for classroom tasks.

Unit – VII

Exercises on

Reading and Writing Skills

Reading Comprehension

Situational dialogues

Letter writing

Essay writing

Unit – VIII

Practice Exercises on Remedial Grammar covering

Common errors in English, Subject-Verb agreement, Use of Articles and Prepositions,

Tense and aspect

Vocabulary development covering

Synonyms & Antonyms, one-word substitutes, prefixes & suffixes, Idioms & phrases, words often confused.

REFERENCES:

1. **Innovate with English: A Course in English for Engineering Students,** edited by T Samson, Foundation Books

2. English Grammar Practice, **Raj N Bakshi, Orient Longman.**

3. **Effective English, edited** by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson

4. Handbook of English Grammar& Usage, **Mark Lester and Larry Beason, Tata Mc Graw –Hill.**

5. Spoken English, **R.K. Bansal & JB Harrison, Orient Longman.**

6. Technical Communication, **Meenakshi Raman, Oxford University Press**

7. Objective English **Edgar Thorpe & Showick Thorpe, Pearson Education**

8. Grammar Games, **Renuvolcuri Mario, Cambridge University Press.**

9. Murphy's English Grammar with CD, **Murphy, Cambridge University Press.**

10. Everyday Dialogues in English, **Robert J. Dixson, Prentice Hall India Pvt Ltd.,**

11. ABC of Common Errors **Nigel D Turton, Mac Millan Publishers.**

12. Basic Vocabulary **Edgar Thorpe & Showick Thorpe, Pearson Education**

13. Effective Technical Communication, **M Ashraf Rizvi, Tata Mc Graw –Hill.**

14. An Interactive Grammar of Modern English, **Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO**

15. A Communicative Grammar of English, **Geoffrey Leech, Jan Svartvik, Pearson Education**

16. Enrich your English, **Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,**

17. A Grammar Book for You And I, **C. Edward Good, MacMillan Publishers.**

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(51002) MATHEMATICS – I

UNIT – I Sequences – Series

Basic definitions of Sequences and series – Convergences and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Raabe's test – Absolute and conditional convergence

UNIT – II Functions of Single Variable

Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized Mean Value theorem (all theorems without proof) Functions of several variables – Functional dependence- Jacobian- Maxima and Minima of functions of two variables with constraints and without constraints

UNIT – III Application of Single variables

Radius, Centre and Circle of Curvature – Evolutes and Envelopes Curve tracing – Cartesian , polar and Parametric curves.

UNIT – IV Integration & its applications

Riemann Sums , Integral Representation for lengths, Areas, Volumes and Surface areas in Cartesian and polar coordinates multiple integrals - double and triple integrals – change of order of integration- change of variable

UNIT – V Differential equations of first order and their applications

Overview of differential equations- exact, linear and Bernoulli. Applications to Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories and geometrical applications.

UNIT – VI Higher Order Linear differential equations and their applications

Linear differential equations of second and higher order with constant coefficients, RHS term of the type $f(X)= e^{ax}$, Sin ax, Cos ax, and $x^n, e^{ax} V(x)$, $x^n V(x)$, method of variation of parameters. Applications bending of beams, Electrical circuits, simple harmonic motion.

UNIT – VII Laplace transform and its applications to Ordinary differential equations

Laplace transform of standard functions – Inverse transform – first shifting Theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Dirac's delta function – Convolution theorem – Periodic function - Differentiation and integration of transforms-Application of Laplace transforms to ordinary differential equations.

UNIT – VIII Vector Calculus

Vector Calculus: Gradient- Divergence- Curl and their related properties Potential function - Laplacian and second order operators. Line integral – work done — Surface integrals - Flux of a vector valued function.

Vector integrals theorems: Green's -Stoke's and Gauss's Divergence Theorems (Statement & their Verification) .

TEXT BOOKS:

1. Engineering Mathematics – I by P.B. Bhaskara Rao, S.K.V.S. Rama Chary, M. Bhujanga Rao.
2. Engineering Mathematics – I by C. Shankaraiah, VGS Booklinks.

REFERENCES:

1. Engineering Mathematics – I by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.
2. Engineering Mathematics – I by D. S. Chandrasekhar. Prison Books Pvt. Ltd.
3. Engineering Mathematics – I by G. Shanker Rao & Others I.K. International Publications.
4. Higher Engineering Mathematics – B.S. Grewal, Khanna Publications.
5. Advance Engineering Mathematics by Jain and S.R.K. Iyengar, Narosa Publications.
6. A text Book of KREYSZIG'S Engineering Mathematics, Vol-I Dr .A. Ramakrishna Prasad, WILEY publications

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(51003) ENGINEERING MECHANICS

UNIT – I

Introduction to Engineering. Mechanics – Basic Concepts.

Systems of Forces : Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

UNIT – II

Equilibrium of Systems of Forces : Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorem, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

UNIT – III

Centroid : Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity : Centre of gravity of simple body (from basis principles), centre of gravity of composite bodies, pappus theorem.

UNIT – IV

Area moment of Inertia : Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia : Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Analysis of perfect frames (Analytical Method) – Types of Frames – Assumptions for forces in members of a perfect frame, Method of joints, Method of sections, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

UNIT – VI

Kinematics : Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics : Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

UNIT – VII

Work – Energy Method : Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

UNIT – VIII

Principle of virtual work: Equilibrium of ideal systems, efficiency of simple machines, stable and unstable equilibriums

TEXT BOOKS :

1. Engineering. Mechanics / Timoshenko & Young.
2. Engineering. Mechanics / S.S. Bhavikatti & J.G. Rajasekharappa

REFERENCES :

1. Engineering Mechanics / Fedinand . L. Singer / Harper – Collins.
2. Engineering. Mechanics / Irving. H. Shames Prentice – Hall.
3. Engineering. Mechanics Umesh Regl / Tayal.
4. Engineering. Mechanics / R.V. Kulkarni & R.D. Askhevkar
5. Engineering. Mechanics/Khurmi/S.Chand.
6. Engineering. Mechanics / KL Kumar / Tata McGraw Hill.

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(51004) ENGINEERING PHYSICS

UNIT-I

1. Bonding in Solids: Ionic Bond, Covalent Bond, Metallic Bond, Hydrogen Bond, Vander-Waal's Bond, Calculation of Cohesive Energy.

2. Crystallography and Crystal Structures: Space Lattice, Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Miller Indices, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Diamond and hcp Structures, Structures of NaCl, ZnS, CsCl.

UNIT-II

3. X-ray Diffraction: Basic Principles, Bragg's Law, Laue Method, Powder Method, Applications of X- ray Diffraction.

4. Defects in Crystals: Point Defects: Vacancies, Substitutional, Interstitial, Frenkel and Schottky Defects; Qualitative treatment of line (Edge and Screw Dislocations) Defects, Burger's Vector, Surface Defects and Volume Defects.

UNIT-III

5. Elements of Statistical Mechanics: Maxwell-Boltzman, Bose-Einstein and Fermi-Dirac Statistics (Qualitative Treatment), Photon gas , Wein's Law, Rayleigh-Jeans law,, Planck's Law of Black Body Radiation, Concept of Electron Gas, Fermi Energy, Density of States.

6. Principles of Quantum Mechanics: Waves and Particles, de Broglie Hypothesis , Matter Waves, Davisson and Germer's Experiment, G. P. Thomson Experiment, Heisenberg's Uncertainty Principle, Schrödinger's Time Independent Wave Equation - Physical Significance of the Wave Function - Particle in One Dimensional Potential Box.

UNIT-IV

7. Band Theory of Solids: Electron in a periodic Potential, Bloch Theorem, Kronig-Penny Model (Qualitative Treatment), Origin of Energy Band Formation in Solids, Classification of Materials into Conductors, Semi Conductors & Insulators, Concept of Effective Mass of an Electron and Hole.

UNIT-V

8. Semiconductor Physics: Fermi Level in Intrinsic and Extrinsic Semiconductors, Intrinsic Semiconductors and Carrier Concentration, Extrinsic Semiconductors and Carrier Concentration, Equation of Continuity, Direct & Indirect Band Gap Semiconductors, Hall Effect.

9. Physics of Semiconductor Devices: Formation of PN Junction, Open Circuit PN Junction, Energy Diagram of PN Diode, I-V Characteristics of PN Junction, PN Diode as a Rectifier (Forward and Reverse Bias), Diode Equation, LED, LCD and Photo Diodes.

UNIT-VI

10. Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities - Internal Fields in Solids, Clausius - Mossotti Equation, Piezo-electricity, Pyro-electricity and Ferro- electricity.

11. Magnetic Properties: Permeability, Field Intensity, Magnetic Field Induction, Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Domain Theory of Ferro Magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Properties of Anti-Ferro and Ferri Magnetic Materials, Ferrites and their Applications, Concept of Perfect Diamagnetism, Meissner Effect, Magnetic Levitation, Applications of Superconductors.

UNIT-VII

12. Lasers: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Carbon Dioxide Laser, Semiconductor Diode Laser, Applications of Lasers.

13. Fiber Optics: Principle of Optical Fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Types of Optical Fibers and Refractive Index Profiles, Attenuation in Optical Fibers, Application of Optical Fibers.

UNIT-VIII

14. Acoustics of Buildings & Acoustic Quieting: Basic Requirement of Acoustically Good Hall, Reverberation and Time of Reverberation, Sabine's Formula for Reverberation Time(Qualitative Treatment), Measurement of

Absorption Coefficient of a Material, Factors Affecting The Architectural Acoustics and their Remedies. Acoustic Quieting: Aspects of Acoustic Quieting, Methods of Quieting, Quieting for Specific Observers, Mufflers, Sound-proofing.

15. Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Precipitation, Combustion Methods; Top-down Fabrication: Chemical Vapour Deposition, Physical Vapour Deposition, Pulsed Laser Vapour Deposition Methods, Characterization(XRD&TEM) and Applications.

TEXT BOOKS:

1. Applied Physics – P.K.Palanisamy (SciTech Publications (India) Pvt. Ltd., Fifth Print 2008).
2. Applied Physics – S.O. Pillai & Sivakami (New Age International (P) Ltd., Second Edition 2008).
3. Applied Physics – T. Bhima Shankaram & G. Prasad (B.S. Publications, Third Edition 2008).

REFERENCES:

1. Solid State Physics – M. Armugam (Anuradha Publications).
2. Modern Physics – R. Murugeshan & K. Siva Prasath – S. Chand & Co. (for Statistical Mechanics).
3. A Text Book of Engg Physics – M. N. Avadhanulu & P. G. Khsirsagar– S. Chand & Co. (for acoustics).
4. Modern Physics by K. Vijaya Kumar, S. Chandralingam: S. Chand & Co.Ltd
5. Nanotechnology – M.Ratner & D. Ratner (Pearson Ed.).
6. Introduction to Solid State Physics – C. Kittel (Wiley Eastern).
7. Solid State Physics – A.J. Dekker (Macmillan).
8. Applied Physics – Mani Naidu Pearson Education

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(51005) ENGINEERING CHEMISTRY

UNIT I:

Electrochemistry and Batteries: Concept of Electro Chemistry, Conductance-Electrolyte in solution, Conductance-Specific, Equivalent and molar conductance, Ionic mobilities, Kolrausch's Law. Application of conductance. EMF: Galvanic Cells, types of Electrodes, Reference Electrode (SCE, Quinhydrone electrode), Ion Selective Electrodes (Glass Electrode) Nernest equation, Concentration Cells, Galvanic series, Potentiometric titrations, Numerical problems.

Batteries: Primary and secondary cells, (lead-Acid cell, Ni-Cd cell, Lithium cells). Applications of batteries, fuel cells – Hydrogen – Oxygen fuel cells, Advantages of fuel cells.

UNIT II:

Corrosion and its corrosion control: Introduction, causes and different types of corrosion and effects of corrosion, theories of corrosion – Chemical, Electrochemical corrosion, corrosion reactions, factors affecting corrosion – Nature of metal – galvanic series, over voltage, purity of metal, nature of oxide film, nature of corrosion product. Nature of environment-effect of temperature, effect of pH, Humidity, effect of oxidant. Corrosion control methods – Cathodic protection, sacrificial anode, impressed current cathode. Surface coatings – methods of application on metals- hot dipping, galvanizing, tinning, cladding, electroplating - Organic surface coatings – paints constituents and functions.

UNIT III:

Polymers: Types of Polymerization, Mechanism (Chain growth & Step growth).Plastics: Thermoplastic resins & Thermo set resins. Compounding & fabrication of plastics, preparation, properties, engineering applications of: polyethylene, PVC, PS, Teflon, Bakelite, Nylon. Conducting Polymers: Poly acetylene, polyaniline, conduction, doping, applications. Liquid Crystal polymers: Characteristics and uses Rubber – Natural rubber, vulcanization. Elastomers – Buna-s, Butyl rubber, Thiokol rubbers, Fibers – polyester, fiber reinforced plastics (FRP), applications

UNIT IV:

Water: Introduction, Hardness: Causes, expression of hardness – units – types of hardness, estimation of temporary & permanent hardness of water, numerical problems. Boiler troubles – Scale & sludge formation, caustic enbsittlement, corrosion, priming & foaming Softening of water (Internal & external treatment-Lime soda, Zeolite, Ion exchange process and Numerical problems) Reverse osmosis, electro dialysis.

UNIT V:

Surface Chemistry: Solid surfaces, types of adsorption, Longmuir adsorption isotherm, BET adsorption equip. Calculation of surface area of solid & application adsorption, classification of colloids, Electrical & optical properties micelles, applications of colloids in industry. Nano materials: Introduction, preparation and applications of nano meterials

UNIT VI:

Energy sources: fuels, classification – conventional fuels (solid, liquid, gaseous) Solid fuels – coal – analysis – proximate and ultimate analysis and their significance Liquid fuels – primary – petroleum – refining of petroleum-cracking knocking synthetic petrol – Bergius and Fischer Tropsech's process; Gaseous fuels – natural gas, analysis of flue gas by Orsat's method Combustion – problems, Calorific value of fuel – HCV, LCV, determination of calorific value by Junker's gas calorie meter.

UNIT VII:

Phase rule: Definitions – phase, component, degree of freedom, phase rule equitation. Phase diagrams – one component system: water system. Two component system lead- silver system, heat treatment based on iron-carbon phase diagram, hardening, annealing.

UNIT VIII:

Materials Chemistry: Cement: composition of Portland cement, manufacture of port land Cement, setting & hardening of cement (reactions). Lubricants: Criteria of a good lubricant, mechanism, properties of lubricants: Cloud point, pour point,flash & fire point,Viscocity. Refractoriess: Classification, Characteristics of a good refractory. Insulators & conductors: Classification of insulators characteristics of thermal & electrical insulators and applications of Superconductors (Nb-Sn alloy, $YBa_2 Cu_3 O_{7-x}$), applications.

TEXT BOOKS:

1. Text Books of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
2. Text of Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co,New Delhi(2006)

REFERENCE BOOKS

1. Engineering Chemistry by B. Siva Shankar Mc.Graw Hill Publishing Company Limited , New Delhi(2006)
2. Enginering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills co., New Delhi (2004).
3. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).
4. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
5. Chemistry of Engineering Meterials by R.P Mani and K.N.Mishra, CENGAGE learning.
6. Applied Chemistry – A text for Engineering & Technology – Springar (2005).
7. Text Book of Engineering Chemistry – Shasi Chawla, Dhantpat Rai publishing Company, NewDelhi (2008).
8. Engineering Chemistry – R. Gopalan, D. Venkatappayya, D.V. Sulochana Nagarajan – Vikas Publishers (2008).

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(51006) COMPUTER PROGRAMMING AND DATA STRUCTURES

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programmes, Software Development Method, Algorithms, Pseudo code, flow charts, applying the software development method.

UNIT - II

Introduction to C Language – Background, Simple C Programme, Identifiers, Basic data types, Variables, Constants, Input / Output, Operators. Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Bit wise operators, Statements, Simple C Programming examples.

Selection Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, goto, Simple C Programming examples.

UNIT - III

Designing Structured Programmes, Functions, basics, user defined functions, inter function communication,

Standard functions, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Preprocessor commands, example C programmes

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C programme examples.

UNIT - IV

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions, command –line arguments.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C programme examples.

UNIT - V

Derived types – Structures – Declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit fields, enumerated types, C programming examples.

UNIT - VI

Input and Output – Concept of a file, streams, standard input / output functions, formatted input / output functions, text files and binary files, file input / output operations, file status functions (error handling), C programme examples.

UNIT – VII

Searching and Sorting – Sorting- selection sort, bubble sort, insertion sort, quick sort, merge sort, Searching-linear and binary search methods.

UNIT - VIII

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack application-infix to postfix conversion, postfix expression evaluation, recursion implementation, Queues-operations, array and linked representations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson education.

REFERENCES:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education
3. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
4. Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion.

5. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition

6. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI

7. C Programming & Data Structures, E. Balagurusamy, TMH.

8. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

9. C& Data structures – E V Prasad and N B Venkateswarlu, S. Chand&Co.

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(51007) ENGINEERING DRAWING

UNIT – I

INTRODUCTION TO ENGINEERING DRAWING: Principles of Engineering Graphics and their Significance – Drawing Instruments and their Use – Conventions in Drawing – Lettering – BIS Conventions. Curves used in Engineering Practice & their Constructions :

a) Conic Sections including the Rectangular Hyperbola – General method only.

b) Cycloid, Epicycloid and Hypocycloid

c) Involute.

d) Scales: Different types of Scales, Plain scales comparative scales, scales of chords.

UNIT – II

DRAWING OF PROJECTIONS OR VIEWS ORTHOGRAPHIC PROJECTION IN FIRST ANGLE

PROJECTION: Principles of Orthographic Projections – Conventions – First and Third Angle, Projections of Points and Lines inclined to both planes, True lengths, traces.

UNIT – III

PROJECTIONS OF PLANES & SOLIDS: Projections of regular Planes, auxiliary planes and Auxiliary projection inclined to both planes. Projections of Regular Solids inclined to both planes – Auxiliary Views.

UNIT – IV

SECTIONS AND SECTIONAL VIEWS:- Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right, Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts. Interpenetration of Right Regular Solids

UNIT – V

INTERSECTION OF SOLIDS:- Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT - VI

ISOMETRIC PROJECTIONS : Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts.

UNIT – VII

TRANSFORMATION OF PROJECTIONS : Conversion of Isometric Views to Orthographic Views – Conventions.

UNIT – VIII

PERSPECTIVE PROJECTIONS : Perspective View : Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).

TEXT BOOK :

1. Engineering Drawing, N.D. Bhat / Charotar
2. Engineering Drawing and Graphics, Venugopal / New age.
3. Engineering Drawing – Basant Agrawal, TMH

REFERENCES :

1. Engineering drawing – P.J. Shah.S.Chand.
2. Engineering Drawing, Narayana and Kannaiah / Scitech publishers.
3. Engineering Drawing- Johle/Tata Macgraw Hill.
4. Computer Aided Engineering Drawing- Trymbaka Murthy- I.K. International.
5. Engineering Drawing – Grower.
6. Engineering Graphics for Degree – K.C. John.

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(51656) COMPUTER PROGRAMMING LAB

Objectives:

1. To make the student learn a programming language.
2. To teach the student to write programs in C to solve the problems.
3. To Introduce the student to simple linear data structures such as lists, stacks, queues.

Recommended Systems/Software Requirements:

1. Intel based desktop PC
2. ANSI C Compiler with Supporting Editors

Week 1.

a) Write a C program to find the sum of individual digits of a positive integer.

b) A Fibonacci Sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 2.

a) Write a C program to calculate the following Sum:

$\underline{\text{Sum=1-x}}^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$

b) Write a C program toe find the roots of a quadratic equation.

Week 3

a) Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

iii) To solve Towers of Hanoi problem.

Week 4

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

b) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 5

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

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices

ii) Multiplication of Two Matrices

Week 6

a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n Characters from a given position in a given string.

b) Write a C program to determine if the given string is a palindrome or not

Week 7

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.

b) Write a C program to count the lines, words and characters in a given text.

Week 8

a) Write a C program to generate Pascal's triangle.

b) Write a C program to construct a pyramid of numbers.

Week 9

Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:

$1+x+x^2+x^3+\ldots\ldots\ldots+x^n$

For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Print x, n, the sum

Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal ? If so, test for them too.

Week 10

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits

after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the

2's complement of a binary number.

b) Write a C program to convert a Roman numeral to its decimal equivalent.

Week 11

Write a C program that uses functions to perform the following operations:

i) Reading a complex number

ii) Writing a complex number

iii) Addition of two complex numbers

iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 12

a) Write a C program which copies one file to another.

b) Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)

Week 13

a) Write a C programme to display the contents of a file.

b) Write a C programme to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Week 14

Write a C program that uses functions to perform the following operations on singly linked list.:

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 15

Write C programs that implement stack (its operations) using

i) Arrays ii) Pointers

Week 16

Write C programs that implement Queue (its operations) using

i) Arrays ii) Pointers

Week 17

Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression

ii) Evaluating the postfix expression

Week 18

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

i) Bubble sort

ii) Selection sort

Week 19

Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers :

i) Linear search ii) Binary search

Week 20

Write C program that implements the following sorting method to sort a given list of integers in ascending order:

i) Quick sort

Week 21

Write C program that implement the following sorting method to sort a given list of integers in ascending order:

i) Merge sort

Week 22

Write C programs to implement the Lagrange interpolation and Newton-Gregory forward interpolation.

Week 23

Write C programs to implement the linear regression and polynomial regression algorithms.

Week 24

Write C programs to implement Trapezoidal and Simpson methods.

Text Books

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications
2. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.
3. The Spirit of C, an introduction to modern programming, M.Cooper, Jaico Publishing House.
4 Practical C Programming,Steve Oualline,O'Reilly,SPD. TMH publications.
5. Computer Basics and C Programming, V. Rajaraman, PHI Publications.
6. Data structures and Program Design in C,R.Kruse,C.L.Tondo,B.P.Leung,M.Shashi,Pearson Education.

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(51657) ENGINEERING PHYSICS / ENGINEERING CHEMISTRY LAB

ENGINEERING PHYSICS LAB

(Any twelve experiments compulsory)

1. Dispersive power of the material of a prism – Spectrometer
2. Determination of wavelength of a source – Diffraction Grating.
3. Newton's Rings - Radius of curvature of plano convex lens.
4. Melde's experiment – Transverse and longitudinal modes.
5. Time constant of an R-C circuit.
6. L-C-R circuit.
7. Magnetic field along the axis of current carrying coil – Stewart and Gees method.
8. Study the characteristics of LED and LASER sources.
9. Study the characteristics of p-i-n and avalanche photodiode detectors.
10. Bending losses of fibres.
11. Evaluation of numerical aperture of given fibre.
12. Energy gap of a material of p-n junction.
13. Thermo electric effect – Seebeck effect and Peltier effect.
14. Torsional pendulum.
15. Single slit diffraction using laser.

ENGINEERING CHEMISTRY LAB

List of Experiments (Any 12 of the following):

Titrimetry:

a. Estimation of hardness of water by EDTA method. (or)

Estimation of calcium in limestone by Permanganometry.

Mineral Analysis:

2 Determination of percentage of copper in brass

3 Estimation of manganese dioxide in pyrolusite.

Instrumental Methods:

4. **Colorimetry:**

Determination of ferrous iron in cement by colorimetric method.

(Or) Estimation of Copper by Colorimetric method.

5. **Conductometry:**

Conductometric titration of strong acid Vs strong base.

(or) Conductometric titration of mixture of acids Vs strong base.

6. **Potentiometry:**

Titration of strong acid Vs strong base by potentiometry.

(or) Titration of weak acid Vs strong base by potentiometry.

Physical Properties:

7. Determination of viscosity of sample oil by redwood/oswald's viscometer

8. Determination Surface Tension of lubricants.

Identification and Preparations:

9. Identification of functional groups present in organic compounds.

10. Preparation of organic compounds

Asprin (or) Benzimidazole

Kinetics:

11. To determine the rate constant of hydrolysis of methyl acetate catalysed

by an acid and also the energy of activation. (or) To study the kinetics of reaction between $K_2S_2O_8$ and KI.

12. Demonstration Experiments (Any One of the following) :

    a. Determination of dissociation constant of weak acid-by PH metry

    b. Preparation of Thiokol rubber

    c. Adsorption on Charcoal

    d. Heat of reaction

TEXT BOOKS:

1. Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
2. Inorganic quantitative analysis, Vogel.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel.
2. A text book on experiments and calculation Engg. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

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(51658) ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

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

Objectives:

1. **To expose the students to a variety of self-instructional, learner-friendly modes of language learning.**
2. **To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.**
3. **To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.**
4. **To train them to use language effectively to face interviews, group discussions, public speaking.**
5. **To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.**

SYLLABUS :

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

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer

8. Debate
9. Telephoning Skills.
10. Giving Directions.

Minimum Requirement:

The English Language Lab shall have two parts:

i) **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor

a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

ii) Headphones of High quality

Suggested Software:

1. Cambridge Advanced Learners' English Dictionary with CD.
1. The Rosetta Stone English Library.
1. Clarity Pronunciation Power – Part I.
1. Mastering English in Vocabulary, Grammar, Spellings, Composition
1. Dorling Kindersley series of Grammar, Punctuation, Composition etc.
1. Language in Use, Foundation Books Pvt Ltd with CD.
1. Oxford Advanced Learner's Compass, 7th Edition.
1. Learning to Speak English - 4 CDs.
1. Vocabulary in Use, Michael McCarthy, Felicity O'Den, Cambridge.

1. Murphy's English Grammar, Cambridge with CD.
1. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. **A Handbook for English Language Laboratories** – Prof. E. Suresh Kumar, P. Sreehari, Foundation Books.
2. **Effective Communication & Public Speaking** by S. K. Mandal, Jaico Publishing House.
3. **English Conversation Practice** by Grant Taylor, Tata McGraw Hill.
4. **Speaking English effectively** by Krishna Mohan, N. P. Singh, Mac Millan Publishers.
5. **Communicate or Collapse: A Handbook of Efffective Public Speaking, Group Discussions and Interviews**, by Pushpa Lata & Kumar, Prentice-Hall of India.
6. **Learn Correct English, Grammar, Usage and Composition** by Shiv. K. Kumar & Hemalatha Nagarajan, Pearson Longman
7. **Spoken English** by R. K. Bansal & J. B. Harrison, Orient Longman.
8. **English Language Communication: A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr. G Natanam & Prof. S. A. Sankaranarayanan, Anuradha Publications, Chennai.
9. **Effective Technical Communication**, M. Ashraf Rizvi, Tata McGraw-Hill.
10. **A Practical Course in English Pronunciation**, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.
11. **A text book of English Phonetics for Indian Students** by T. Balasubramanian, Mac Millan .
12. **Spoken English: A foundation Course, Parts 1 & 2, Kamalesh Sadanand and Susheela punitha**, Orient Longman

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Paper:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-end Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year-end Examination shall be conducted by an external examiner/ or the teacher concerned with the help of another member of the staff of the same department of the same institution.

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(51659) ENGINEERING WORKSHOP / IT WORKSHOP

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-Smithy and Development of jobs carried out and soldering.
4. Black Smithy
5. House-wiring
6. Foundry
7. Welding
8. Power tools in construction, wood working, electrical engineering and mechanical Engineering.
9. IT Workshop-I : Computer hard ware , identification of parts , Disassembly, Assembly of computer to working condition, Simple diagnostic exercises.
10. IT workshop-II : Installation of Operating system windows and Linux , simple diagnostic exercises.

2. TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Machine Shop
3. Metal Cutting (Water Plasma)

TEXT BOOK:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2. Workshop Manual by Venkat Reddy

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(53001) MATHEMATICS – II

UNIT – I: Linear Systems

Matrices: Elementary row transformations – Rank – Normal form - Echelon form – Consistency – Solution of system of simultaneous linear homogeneous and non-homogeneous equations.

UNIT – II : Eigen values & Eigen vectors

Eigen Values, Eigen vectors - properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonolization of matrix. Calculation of powers of matrix – Modal and spectral matrices.

UNIT-III: Linear Transformations

Real matrices -Symmetric, skew - symmetric, orthogonal, Linear Transformation - Orthogonal Transformation. Complex matrices: Hermitian, Skew-Hermitian and Unitary – Eigen values and Eigen vectors of complex matrices and their properties.

UNIT –IV: Quadratic forms

Quadratic Forms - Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index - signature - Sylvester law, Applications of quadratic forms.

UNIT-V : Fourier Series

Fourier Series: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

UNIT –VI : Introduction to partial differential equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations.

UNIT –VII: Solution of partial differential equations

Classification of second order linear Partial Differential Equations, separation of variables methods for the solutions of one dimensional heat equation,

wave equation and two-dimensional Laplace's equation under initial and boundary conditions.

UNIT-VIII: Fourier transforms

Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

TEXT BOOKS:

1. Engineering Mathematics – II by P.B. Bhaskara Rao, S.K.V.S. Rama Chary, M.Bhujanga Rao, B.S. Publications.
2. Engineering Mathematics – II by G.Shankar Rao & Others, I.K. International Publications.

REFERENCES:

1. Engineering Mathematics – II by T.K.V. Iyengar, B.Krishna Gandhi & Others, S.Chand.
2. Higher Engineering Mathematics by B.S.Grewal, Khanna Publications.
3. Engineering Mathematics – II by Engineering Mathematics – II by C. Shankaraiah, Vijaya Publications.
4. Advanced Engineering Mathematics by Jain and S.R.K. Iyengar, Narasa Publications.
5. Engineering Mathematics – II by Dr. A. Anjaneyulu & others, Deepti Publications.

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(53017) THERMODYNAMICS

UNIT – I

Introduction: Basic Concepts : System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function.

UNIT II

Zeroth Law of Thermodynamics – Concept of quality of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

UNIT – III

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

UNIT IV

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT - V

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables.

UNIT – VI

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT - VII

Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

UNIT VIII

Refrigeration Cycles : Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell-

Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS :

1. Engineering Thermodynamics / PK Nag /TMH, III Edition
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH

REFERENCES :

1. An introduction to Thermodynamics - YVC Rao / University press
2. Solution Manual to Introduction to Thermodynamics, YVC Rao / University Press

3. Engineering Thermodynamics – Jones & Dugan
4. Thermodynamics – Robert Balmer, Jaico Pub.
5. Thermodynamics – J.P.Holman, McGrawHill
6. Engineering Thermodynamics – K. Ramakrishna, Anuradha Publishers.
7. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen , John Wiley & sons (ASIA) Pte Ltd

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(53016) MECHANICS OF SOLIDS

UNIT – I

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

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

UNIT – IV

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

UNIT – V

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

UNIT – VI

DEFLECTION OF BEAMS : Bending into a circular arc -- slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method -- application to simple cases including overhanging beams.

UNIT – VII

THIN CYLINDERS : Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells -- Thin spherical shells.

UNIT – VIII

Thick cylinders–lame's equation – cylinders subjected to inside & out side pressures -- compound cylinders.

TEXT BOOKS :

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH

REFERENCES:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
4. Strength of Materials by S.Timshenko

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(53043) MECHANICS OF FLUIDS

UNIT I

Fluid Properties And Fluid Statics: Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Pressure at a point, Pascal's law, pressure variation with temperature, density and attitude. Hydrostatic law, Piezometer, Simple and differential manometers, pressure gauges, total pressure and center of pressure plane, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT II

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

UNIT III

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

UNIT IV

Similitude and Flow Measurement Similarly laws, distorted models. Flow through Venturimeters and Orificemeter, flow through notches and weirs, Viscometers, Hotwire Anemometers, Pitot tube, Flow through nozzles.

UNIT V

Approximate solutions of N.S. Equations - Boundary layer- concepts, Prandtl contribution,Characteristices of boundary layer along a thin flat plate Von-karman's momentum integral equation (No derivation), laminar and turbulent Boundary layers,BL in transition,separation of BL,control of BL separation,flow around submerged objects, Drag and lift types of drag magnus effect.

UNIT VI

Closed Conduit Flow: Characteristics of real fluids Reynolds experiment

Darcy's equation, Minor losses pipes in series pipes in parallel Total energy line and hydraulic gradient line.

UNIT VII

Exact Solutions of Navier Stokes Equations. Flow between parallel plates, flow through long tubes - Fow through inclined tubes, Turbulent flow, variation of friction factor with Reynold's Number Mody's chart.

UNIT VIII

Flow of Compressible Fluid: Introduction, Thermodynamic relations, basic equations of compressible flow, velocity of sound wave in a fluid for isothermal and adiabatic process, mach number and its applications, mach angle, Propagation of Pressure waves and stagnation properties

TEXT BOOKS:

1. Fluid Mechanics Hydraulics and Hydraulics Machines Modi & Seth, Standard publications, New Delhi.
2. Engineering Fluid Mechanics by K.L.Kumar, S.Chand & Co.

REFERENCES:

1. Fluid Mechanics Frnk in white Mc-Grawhill.
2. Fluid Mechanics - John F.Dauglas, Pearson Educations publishers.
3. Fluid Mechanics & Hydraulic Machines - D. Ramadurgaiah, Newage Publishers 2005.

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(53044) INTRODUCTION TO AEROSPACE ENGINEERING

UNIT – I

HISTORY OF FLIGHT

Balloons and dirigibles, heavier than air aircraft, commercial air transport, introduction of jet aircraft, helicopters, conquest of space, commercial use of space, exploring solar system and beyond, a permanent presence of humans in space.

UNIT – II

INTRODUCTION TO ENGINEERING

The ages of engineering, the bronze age, iron age, the middle ages, the renaissance, the industrial revolution, Indian science and technology through the ages.

UNIT – III

AERODYNAMICS AND FLIGHT VEHICLE PROPULSION

Aerodynamic forces on a wing, force coefficients. Generating lift. Moment coefficients, centre of pressure aerodynamic of wings. Sources of drag. Thrust for flight, the propeller and the jet engine, governing equations, rocket engines.

UNIT – IV

FLIGHT VEHICLE PERFORMANCE AND STABILITY

Anatomy of the airplane, helicopter, launch vehicles and missiles, space vehicles. Static forces and moments on the vehicle. Understanding engineering models. Performance parameters, performance in steady flight, accelerated flight. Stability, static stability, dynamic stability. Longitudinal and lateral stability.

UNIT – V

THE SPACE ENVIRONMENT

Earth's atmosphere, the standard atmosphere. The temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity. The near earth radiative environment. The magnetosphere. Environmental impact on spacecraft. Meteoroids and micrometeoroids, space debris. Planetary environments.

UNIT – VI

SATELLITE SYSTEMS ENGINEERING

Satellite missions, an operational satellite system, elements of satellite, satellite bus subsystems. Satellite structures, mechanisms and materials. Power systems. Communication and telemetry. Thermal control. Attitude determination and control. Propulsion and station keeping. Space missions. Mission objectives. Case studies.

UNIT – VII

VII HUMAN SPACE EXPLORATION

Goals of human space flight missions. Historical background. The Soviet and US missions. The Mercury, Gemini, Apollo (manned flight to the moon), Skylab, Apollo-Soyuz, Space Shuttle. International Space Station, extravehicular activity. The space suit. The US and Russian designs. Life support systems. Flight safety. Indian effort in aviation, missile and space technology.

UNIT – VIII

ENGINEERING DESIGN

Design as a critical component of engineering education. Design as a skill. The design process, design thinking and design drawing. Design for mission, performance and safety requirements. Concurrent engineering. Computer aided engineering, design project. Example: the lighter-than –air vehicle student design project of MIT.

TEXT BOOKS

1. Newman, D., Interactive Aerospace Engineering and Design, (with software and reference material on CD), McGraw-Hill, 2002, ISBN 0-07-112254-0
2. Aircraft Flight, 3rd edition, Barnard, R. H. and Philpot, D.R., Pearson, 2004,ISBN: 81-297-0783-7.
3. Anderson, J.D., Introduction to Flight, fifth edition, Tata McGraw-Hill, 2007, ISBN: 0-07-006082-4.

REFERENCES:

1. Numerous references cited in Newman's book.
2. NASA Education Home Page, http://www.ne.nasa.gov/education.
3. The Wikipedia: Transportation Systems, Air Transportation, Aviation.

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(53013) ENVIRONMENTAL STUDIES

UNIT-I : ECOSYSTEMS: Definition, Scope and Importance of ecosystem. Concept of ecosystem, Classification of ecosystems, Structure and Structural Components of an ecosystem, Functions of ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Homeostasis / Cybernetics, Food chain concentration, Biomagnification, ecosystems value, services and carrying capacity.

UNIT-II: NATURAL RESOURCES: Classification of Resources: Living and Non-Living resources, Renewable and non-renewable resources. Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources – 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 and land use / land cover mapping.

UNIT-III: BIODIVERSITY AND BIOTIC RESOURCES: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and intrinsic values. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, conservation of biodiversity: In-Situ and Ex-situ conservation. Food and fodder resources, Timber and non-timber forest products.

UNIT-IV: ENVIRONMENTAL POLLUTION AND CONTROL: Classification of pollution and pollutants, causes, effects and control technologies. Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Point and non-point sources of pollution, Major pollutant of water and their sources, drinking water quality standards, Waste water treatment methods: effluent treatment plants (ETP), Sewage treatment plants (STP), common and combined effluent treatment plants (CETP).Soil Pollution: Soil as sink for pollutants, Impact of modern agriculture on soil, degradation of soil. Marine Pollution: Misuse of International water for dumping of hazardous waste, coastal pollution due to sewage and marine disposal of industrial

effluents. Noise Pollution: Sources, Industrial Noise- Occupational Health hazards, standards, Methods of control of Noise. Thermal Pollution: Thermal Comforts, Heat Island effect, Radiation effects. Nuclear Pollution: Nuclear power plants, nuclear radiation, disasters and impacts, genetical disorders. Solid waste: types, Collection processing and disposal of industrial and municipal solid wastes composition and characteristics of e-Waste and its management.

UNIT-V: GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS : Green house effect, Green House Gases (GHG), Global Warming, Sea level rise, climate change and their impacts on human environment. Ozone depletion and Ozone depleting substances (ODS).Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT-VI: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND ENVIRONMENTAL MANAGEMENT PLAN: Definition of Impact: classification of impacts, Positive and Negative, Reversible and irreversible, light, moderate and severe, methods of baseline data acquisition. Impacts on different components: such as human health resources, air, water, flora, fauna and society. Prediction of impacts and impact assessment methodologies. Environmental Impact Statement (EIS). Environmental Management Plan (EMP): Technological Solutions, preventive methods, Control technologies, treatment technologies: green-belt-development, rain water harvesting, Remote sensing and GIS methods.

UNIT-VII: ENVIRONMENTAL POLICY, LEGISLATION, RULES AND REGULATIONS

National Environmental Policy, Environmental Protection act, Legal aspects Air (Prevention and Control of pollution) Act- 1981, Water(Prevention and Control of pollution) Act-1974, Water pollution Cess Act-1977, Forest Conservation Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules .

UNIT: VIII — TOWARDS SUSTAINABLE FUTURE

Concept of Sustainable Development, Threats to Sustainability, Population and its explosion, Crazy Consumerism, Over-exploitation of resources, Strategies for Achieving Sustainable development, Environmental Education, Conservation of Resources, Urban Sprawl, Sustainable Cities and Sustainable Communities, Human health, Role of IT in Environment, Environmental Ethics,

Environmental Economics, Concept of Green Building, Clean Development Mechanism (CDM).

SUGGESTED TEXT BOOKS:

1. Environmental studies , From crisis to cure by R.Rajagopalan, 2005
2. Text book of Environmental Science and Technology by M.Anji Reddy 2007
3. Environmental studies by Erach Bharucha 2005, University Grants Commission, University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. AE. I Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

(53628) AIRCRAFT ENGINEERING DRAWING LAB with CAD

Note: 40% Course Work Should be Done on Drawing Board & 60% Course Work Should Be Done By Computer.

UNIT : I

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

a) Conventional representation of materials , common machine elements and parts such as screws, nuts ,bolts, keys, gears, webs, ribs

b) Types of sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned

c) Methods of dimensioning , general rules for sizes and placement of dimensions for holes ,centers, curved and Tapered features

d) Title boxes, their size, location and details –common abbreviations and their liberal usage.

e) Types of drawing – working drawing for machine parts

UNIT : II

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

a) Popular forms of screw threads, bolts, set screws and bolted joints.

b) Keys,cottered joint and knuckle joint

c) Riveted joints for plates.

d) Shaft couplings, spigot and socket pipe joint.

e) Journal, pivot, collar and foot step bearing

f) Welded joints and welding symbols.

UNIT : III

Following simple Aircraft assembly drawings only.

a) Different types of trusses used in wings fuselage including ribs, striengers,skin,brakets

b) Different elements of fuselage structures ,bulk head , rings (frame) long irons

c) Different types of fuselage.

d) landing gear basic elements ,structural brackets ,wheel, shock absorber and Hydraulic cylinder

e) connecting rod for aero piston engine

Text Books:

1. Daniel P. Raymer Aircraft Design a Conceptual Approach Third Addition.
2. Machine drawing by N.D. Baht / V.M. Panchal / Charotar Publication House – 2000 Ed .
3. Megson THG, "Aircraft Structures for Engineering Students", Edward Arnold Publication.

REFERENCES:

1. Machine Drawing by K.L.Narayana, P.Kannaiah and K.Venkata Reddy / New Age Publishers.
2. Air Craft structures by Bruhn.E.H
3. Machine Drawing by P.S.Gill
4. Machine Drawing by Luzzader
5. Machine Drawing by Rajput.

Equipment Needed

1. Hardware assembly models relevant to above are needed for demonstration
2. Drawing Boards with Mini drafting machines, 60 required for strength of 60 capacity.

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II Year B.Tech. AE. I Sem	**L**	**T/P/D**	**C**
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(53629) MECHNICS OF SOLIDS AND MECHNICS OF FLUIDS LAB

(A) MECHNICS OF SOLIDS LAB :

1. Direct tension test
2. Bending test on
   a) Simple supported
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brinells hardness test
   b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

(B) MECHNICS OF FLUIDS LAB

1. Calibration of Venturimeter
2. Determination of co-efficient of discharge for a small orifice by a constant head method.
3. Calibration of Triangular not Ch
4. Verification of Bernailli's apparatus.
5. Pipe friction.
6. Calibration of orifice meter
7. Determination of co-efficient of discharge for an external mouth piece by variable head method.
8. Determination of co-efficient of loss of head in a sudden retraction.

Note: A minimum of Ten experiments should be taking at least four experiments from each lab.

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II Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	4	**1/-/-**	**4**

(54040) AERODYNAMICS – I

Tables, plots required to be supplied to candidates for reference during examination:

- *Typical three bladed propeller charts as follows.*
- *1. Propeller geometry;*
- *2, 3, 4, VI/nD vs C_T, C_P, η; 5. C_S vs ς.*

UNIT – I:
REVIEW OF FLUID MECHANICS

Aerodynamics – importance, the flow field, fundamental aerodynamic variables, aerodynamic force & moment coefficients, dimensional analysis, flow similarity, classification of fluid flows. The continuity, momentum and energy equations in integral form and in differential form. Euler's equation. Methods of determination of flow – analytical and numerical methods.

UNIT – II:
INVISCID, INCOMPRESSIBLE FLOW

Angular velocity, vorticity and circulation. Kelvin's theorem. Irrotational flow. The velocity potential. Stream function for two dimensional incompressible flow. Laplace's equation. Boundary conditions at infinity and at the wall. Elementary flows and their combinations, non-lifting flow over a circular cylinder, vortex flow, lifting flow over a cylinder. D'Alembert's paradox. Kutta Joukowski theorem and generation of lift. Non-lifting flows over arbitrary bodies – numerical source panel method. Real flow over a circular cylinder.

UNIT – III:
VISCOUS FLOW AND BOUNDARY LAYERS

Role of viscosity in fluid flow. The Navier-Stokes' equation, boundary layer approximation. Boundary layer thicknesses, growth along a flat surface. Laminar boundary layers. Surface friction drag. Boundary layer separation. Transition. Turbulent boundary layers, turbulence modelling, eddy viscosity and mixing length concepts. The momentum integral equation. Approximate solutions for laminar, turbulent and mixed boundary layers - computational methods. Thermal boundary layer. Reynolds's analogy.

UNIT – IV:

INCOMPRESSIBLE FLOW OVER AIRFOILS

Theoretical solutions of low speed flow over airfoils - the vortex sheet representation. The Kutta condition. Kelvin's circulation theorem and the starting vortex. The thin airfoil theory. The aerodynamic centre. Lifting flows over arbitrary bodies – the vortex panel numerical method. Airfoil design for prescribed lift distribution. Real flow over an airfoil. Effect of boundary layer transition and surface roughness on the aerodynamic forces.

UNIT – V:

INCOMPRESSIBLE FLOW OVER WINGS & BODIES - I

Downwash and induced drag. The vortex filament – Biot-Savart's law, Helmholtz's theorems. The starting, bound and trailing vortices. Prandtl's classical lifting line theory for unswept wings– determination of lift, vortex induced drag. Nonlinear lifting-line, lifting surface and vortex lattice numerical methods.

UNIT VI:

INCOMPRESSIBLE FLOW OVER WINGS AND BODIES - II

The mechanism of lift generation on delta wing in subsonic flow. Leading edge extensions to wings. Three dimensional flow – source, doublet, flow over a sphere. General three dimensional flows – panel techniques. Real flow over a sphere. Asymmetric loads on fuselage at high angles of attack – asymmetric vortex shedding, wake-like flows. Flow field about aircraft at high angles of attack.

UNIT – VII

AERODYNAMIC CHARACTERISTICS OF AIRFOILS AND WINGS

Aerodynamic force and moment coefficients. The drag polar. The lift curve slope, maximum lift coefficient, minimum drag coefficient, lift drag ratio - effect of airfoil and wing geometry parameters, Reynolds' no., boundary layer transition and surface roughness. NACA airfoils, laminar flow airfoils, supercritical airfoils. Aerodynamics of drag reduction and lift augmentation methods - flap systems, leading edge devices, multi-element airfoils, power augmented lift, circulation control, laminar flow control, winglets.

UNIT VIII

PROPELLERS

Geometry of the propeller, Rankine - Froude momentum theory of propulsion, airscrew coefficients, thrust, torque, power coefficients, propulsive efficiency, activity factor, airscrew pitch; geometric pitch, experimental mean pitch, effect of geometric pitch on airscrew performance, blade element theory, the vortex

system of an airscrew, rotational inflow and outflow, performance of a blade element, compressibility effects, use of propeller charts, propeller selection, propeller design.

TEXT BOOKS

1. Aerodynamics for Engineers, fourth edition, Bertin, J.J., Pearson Education, 2002, ISBN: 81-297-0486-2
2. Fundamentals of Aerodynamics, Anderson, Jr., J.D., International edition, McGraw-Hill, 2001, ISBN: 0-07-118146-6.
3. Kuethe, A.M., and Chow, C., Foundations of Aerodynamics, 5th Edn., Wiley, 1998,ISBN: 0-471-12919-4.

REFERENCES

1. Kuchemann, D., The Aerodynamic Design of Aircraft, Pergamon, 1978.
2. Shevell, R.S., Fundamentals of Flight, Indian reprint, Pearson Education, 2004, ISBN: 81-297-0514-1.
3. McCormick, B.W., Aerodynamics, Aeronautics & Flight Mechanics, second edition John Wiley, 1995, ISBN: 0-471-57506-2.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. AE. II Semester	L	T/P/D	C
	3	1/-/-	3

(54041) AIRCRAFT PRODUCTION TECHNOLOGY

UNIT – I

INTRODUCTION

Classification and comparison (merits and limitations) of manufacturing process, criterion for selection of a process

General principles of various Casting Processes - Sand casting, die-casting, centrifugal casting, investment casting, shell molding types

UNIT – II

WELDING AND BONDING TECHNIQUES

Principles and equipment used in arc welding, gas welding, resistance welding, thermit welding, recent advances in welding technology, Soldering and brazing techniques.

UNIT - III

MACHINING

General Principals (with schematic diagram only) of working and types-lathe, shaper, milling machines, grinding, drilling m/c, CNC machining and general principles.

UNIT - IV

SHEET METAL FORMING

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

UNIT- V

UNCONVENTIONAL MACHINING

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

UNIT-VI

HEAT TREATMENT AND SURFACE FINISHING

Heat treatment of Aluminum alloys, titanium alloys, steels, case hardening,

Initial stresses and the stress alleviation procedures. Corrosion prevention, protective treatment for aluminum alloys, steels, anodizing of titanium alloys, organic coating, and thermal spray coatings. Grinding and Polishing, Burnishing, Lapping.

UNIT - VII

AIRCRAFT ASSEMBLY

Aircraft Tooling Concepts, Jigs, fixtures, stages of assembly, types and equipment for riveted joints, bolted joints (only).

UNIT - VIII

QUALITY CONTROL AND ASSURANCE

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

NDT AND OTHER INSPECTION TECHNIQUES

Dye Penetrant Test, X - ray, magnetic particle and ultrasonic testing. Accoustic holography.

TEXTBOOKS:

1. "Air craft production techniques" Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993
2. "Manufacturing Engineering and Technology" by Kalpakajam – Addison Wesley.

REFERENCES:

1. "Production technology"- R.K. Jain – Khanna Publishers – 2002.
2. "Production technology"-O.P.Khanna and lal. M.Dhanpat rai publications-New Delhi-1997

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. AE. II Semester	L	T/P/D	C
	4	-/-/-	4

(54042) ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT - I

ELECTRICAL CIRCUITS: Basic definitions, Types of elements, Ohm's Law, Resistive networks,

Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and

delta-star transformations.

UNIT - II

DC MACHINES : Principle of operation of DC Generator – emf equation - types – DC motor types –

torque equation – applications – three point starter.

UNIT - III

TRANSFORMERS : Principle of operation of single phase transformers – emf equation – losses –

efficiency and regulation

UNIT - IV

AC MACHINES : Principle of operation of alternators – regulation by synchronous impedance method –

Principle of operation of induction motor – slip – torque characteristics – applications.

UNIT - V

INSTRUMENTS : Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

UNIT - VI

DIODE AND IT'S CHARACTERISTICS : P-n junction diode, symbol, V-I Characteristics, Diode

Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems)

UNIT - VII

TRANSISTORS : PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics

and applications

UNIT - VIII

CATHODE RAY OSCILLOSCOPE : Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity,

Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOKS:

1. Essentials of Electrical and Computer Engineering by David V. Kerns, JR. J. David Irwin/Pearson.
2. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand & Co.

REFERENCES:

1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
2. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.

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II Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(54043) AEROSPACE VEHICLE STRUCTURES – I

UNIT I

REDUNDANT STRUCTURES

Indeterminate structures and order of redundancy , Introduction to redundant analysis, Statically determinate models, Use of free body diagrams to explain compatibility and redundant analysis principles. Matrix methods of redundant analysis utilizing (a) equilibrium equations / compatibility conditions and (b) Singularity method for uniform beams with various boundary and support conditions (props, hinges and fixities) subjected to distributed / discrete loads (including moments).

UNIT II

BEAMS WITH ELASTIC SUPPORTS AND INITIAL CURVATURE:

Direct solution of beams on elastic foundation, Deflection of beams with discrete elastic supports using singularity methods and modeling concepts. Equation of equilibrium for curved beam stress and deflections of a typical curved beam (Bulk Head segments on fuselages).

UNIT III

STABILITY

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

UNIT IV

INTRODUCTION TO THEORY OF ELASTICITY

Equilibrium and Compatibility conditions for elastic solids, 2D elasticity equations for plane stress, plane strain and generalized plane strain cases Airy's stress function. Simple problems in plane stress / plane strain using Cartesian and polar coordinates. Super position techniques Examples include

(a) panels subjected to a generalized plane strain Biaxial loading (b) Uniform/ Linearly varying edge loads on elastic half plane (c) Thick cylindrical shells.

UNIT V

Stresses and Strains on arbitrary planes and transformations. Concept of principal planes, stress and Strains, Construction of Mohr's circle, Failure mechanism and fracture modes.

UNIT - VI

ENERGY PRINCIPLES AND METHODS

Introduction to energy principles and methods. Principles of Virtual Displacement and Principle of Virtual Force Castigliano's theorems, Maxwell's reciprocal theorem and Unit load method. Direct application of energy principles to beams and trusses.

UNIT – VII

The displacement method (Rayleigh Ritz method). Admissible functions energy and work expressions for redundant analysis of 1-D structures (rods, shafts and beams). Various 1D Structures subjected to Complex loading. Stresses of errors and convergence.

UNIT - VIII

SHEAR FLOW IN CLOSED SECTIONS

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

TEXTBOOKS:

1. Timoshenko S. P. and J.N. Goodier, "Theory of Elasticity McGraw Hill Book Co.
2. Megson THG, "Aircraft Structures for Engineering students", Edward Arnold Publication.
3. David J. Peery" Aircraft Structures" McGRAW-HILL Book Company.

REFRENCES

1. Shames I. H. and Dym C. L, Energy and finite element methods structural analysis McGraw Hill

2. B.C.Punmia, "Theory of Structures", Laxmi Publication.

3. S.Ramamrutham, R.Narayanan, "Theory of Structures" – Dhanpat Rai Publishing Co, 2003.

4. Argyris J. H. and Kelsey S. Energy theorems and structural analysis, Butterworths Scientific Publications.1960

5. Donaldson, B. K. Analysis of Aircraft Structues-An introduction "McGraw Hill.

6. David H. Allen, and Walter E. Haiseler Introduction to Aeronautical Stuructre Analysis, John Wiley & Son, 1985.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(54044) INTRODUCTION TO SPACE TECHNOLOGY

UNIT-I

INTRODUCTION

Space Mission-Types-Space Environment-Launch Vehicle Selection

UNIT II

FUNDAMENTALS OF ROCKET PROPULSION

Introduction to rocket propulsion-fundamentals of solid propellant rockets-Fundamentals of liquid propellant rockets-Rocket equation

UNIT-III

ASCENT FLIGHT MECHANICS OF ROCKETS AND MISSILES

Two-dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two stage Multi-stage Rockets-Trade-off Ratios-Single Stage to Orbit- Sounding Rocket-Aerospace Plane-Gravity Turn Trajectories-Impact point calculation-Injection conditions-Flight dispersions

UNIT-IV

ATMOSPHERIC REENTRY

Introduction-Steep Ballistic Reentry-Ballistic Orbital Reentry-Skip Reentry-"Double-

Dip" Reentry - Aero-braking - Lifting Body Reentry

UNIT-V

FUNDAMENTALS OF ORBITAL MECHANICS

Two-body motion-Circular, elliptic, hyperbolic, and parabolic orbits-Basic Orbital Elements-Ground Trace

UNIT-VI

ORBITAL MANEUVERS

In-Plane Orbit changes-Hohmann Transfer-Bielliptical Transfer-Plane Changes- Combined Maneuvers-Propulsion for Maneuvers

UNIT-VII

SATELLITE ATTITUDE DYNAMICS

Torque free Axi-symmetric rigid body-Attitude Control for Spinning Spacecraft - Attitude Control for Non-spinning Spacecraft - The Yo-Yo Mechanism – Gravity – Gradient Satellite-Dual Spin Spacecraft-Attitude Determination

UNIT-VIII

SPACE MISSION OPERATIONS

Supporting Ground System Architecture and Team Interfaces - Mission phases and Core operations- Team Responsibilities – Mission Diversity – Standard Operations Practices

TEXT BOOKS

1. "Spaceflight Dynamics", W.E. Wiesel, McGraw-Hill, 1997
2. "Rocket Propulsion and Space flight dynamics", Cornelisse, Schoyer HFR, and Wakker KF, Pitman, 1984
3. Vincet L. Pisacane, " Fundamentals of Space Systems" , Oxford University Press, 2005.

REFERENCES

1. "Understanding Space: An Introduction to Astronautics", J.Sellers, McGraw- Hill, 2000
2. "Introduction to Space Flight", Francis J Hale, Prentice-Hall, 1994
3. "Spacecraft Mission Design", Charles D.Brown, AIAA Education Series, 1998
4. "Spacecraft Mission Design", Charles D.Brown, AIAA Education Series, 1998
5. "Elements of Space Technology for Aerospace Engineers", Meyer Rudolph X, Academic Press, 1999

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II Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	4	**1/-/-**	**4**

(54045) FLIGHT MECHANICS – I

UNIT – I:

INTRODUCTION TO AIRCRAFT PERFORMANCE

The role and design mission of an aircraft. Specification of the performance requirements and mission profile. Importance of performance analysis, estimation and measurement and operational safety and economy. Scheduled performance and operational performance of aircraft. The Standard Atmosphere. Off-standard and design atmosphere. Measurement of air data. Air data computers.

UNIT – II:

THE FORCE SYSTEM OF THE AIRCRAFT

Equations of motion for performance - the aircraft force system. The lift force, side force, the drag force. Total airplane drag - drag estimation, drag reduction methods.

The propulsive forces - the thrust producing engines, power producing engines, variation of thrust, propulsive power and specific fuel consumption with altitude and flight speed. The minimum drag speed, minimum power speed. Aerodynamic relationships for a parabolic drag polar.

UNIT – III:

CRUISE PERFORMANCE

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

UNIT – IV:

CLIMB AND DESCENT PERFORMANCE

Importance of climb and descent performance, safety considerations. Climb

and descent techniques, generalised performance analysis for thrust producing, power producing and mixed power-plants, maximum climb gradient, climb rate. Energy height and specific excess power, energy methods for optimal climbs – minimum time climbs, minimum fuel climbs. Measurement of climb performance. Descent performance in aircraft operations. Effect of wind on climb and descent performance.

UNIT – V:

AIRCRAFT MANOEUVRE PERFORMANCE

The general equations of accelerated motion of aircraft, the manoeuvre envelope, significance. Longitudinal aircraft manoeuvres, the pull-up manoeuvre, Lateral manoeuvres, turn performance, turn rates, turn radius, limiting factors for turning performance, instantaneous turns and sustained turns, specific excess power, the energy turns. The manoeuvre boundaries. Military aircraft manoeuvre performance. Transport aircraft manoeuvre performance.

UNIT – VI:

AIRCRAFT PERFORMANCE MEASUREMENT AND DATA HANDLING

Purpose of performance measurement in flight. Flight testing. Principal performance variables – weight, altitude and ambient temperature (WAT). Parametric performance data analysis. Dimensional analysis. Measurement of cruise performance, climb, take-off and landing. Performance data reduction. The equivalent weight method. Corrections to cruise, climb, take-off and landing performance for weight and temperature.

UNIT – VII:

SAFETY REQUIREMENTS – TAKE-OFF AND LANDING - PERFORMANCE PLANNING

Flight safety criteria. Performance classification of civil aircraft. Flight planning - performance planning and fuel planning.

Estimation of take-off distances. The effect on the take-off distance, of weight, wind, runway conditions, ground effect. Take-off performance safety factors. Estimation of landing distances - the discontinued landing, baulked landing, air safety procedures and requirements on performance.

Fuel planning, fuel requirements, trip fuel, environmental effects, reserves, tankering.

UNIT – VIII:

THE APPLICATION OF PERFORMANCE DATA

The performance summary for fleet selection - the block performance, payload – range diagram. route analysis and optimisation. Operational analysis procedure.

Operational performance data for flight planning– take-off field performance, runway correction chart, aircraft datum performance (WAT) chart, determination of the maximum take-off weight.

TEXT BOOKS

1. Eshelby, M.E., Aircraft Performance: Theory and Practice, AIAA Education Series, AIAA, 2000, ISBN: 1-56347-398-4.
2. Brandt, S.A. et. al., Introduction to Aeronautics: A Design Perspective, Second Edition, AIAA Education Series, AIAA, 2004, ISBN: 1-56347-701-7
3. Anderson, J.D. Jr., Aircraft Performance and Design, international edition, McGraw-Hill, 1999, ISBN: 0-07-001971-1.

REFERENCES

1. Dole, C.E., Flight Theory and Aerodynamics: a Practical Guide for Operational Safety, Wiley Interscience, 1981, ISBN: 0-471-09152-9.
2. McCormick, B.W, Aerodynamics, Aeronautics and Flight Mechanics, second edition, John Wiley, 1995, ISBN: 0-471-57506-2.
3. Shevel, R.S., Fundamentals of Flight, second edition, Pearson Education, 1989, ISBN: 81-297-0514-1.
4. Raymer, D.P., Aircraft Design: A Conceptual Approach, third edition, AIAA Education Series, AIAA, 1999, ISBN: 1-56347-281-0
5. Yechout, T.R. et al., Introduction to Aircraft Flight Mechanics, AIAA Education Series, AIAA, 2003, ISBN: 1-56347-577-4.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

(54632) AIRCRAFT PRODUCTION TECHNOLOGY LAB

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

PRODUCTION LAB

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

Reference:

1. "Air craft production techniques" Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993
2. "Manufacturing Engineering and Technology" by Kalpakajam – Addison Wesley.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. AE. II Semester	L	T/P/D	C
	0	-/3/-	2

(54633) ELECTRICAL AND ELECTRONICS ENGINEERING LAB

SECTION A: ELECTRICAL ENGINEERING:

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

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

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

5. Speed control of D.C. Shunt motor by

   a) Armature Voltage control b) Field flux control method
6. Brake test on D.C Shunt Motor

SECTION B: ELECTRONICS ENGINEERING :

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. AE. I Semester

L	T/P/D	C
3	1/-/-	3

(55010) MANAGEMENT SCIENCE

Unit I

***Introduction to Management*:** Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

Unit II

***Designing Organisational Structures*:** Departmentation and Decentralisation, Types of Organisation structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

Unit III

***Operations Management*:** Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control: $\overline{X}$ chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

Unit IV

***A) Materials Management*:** Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records - Supply Chain Management

***B) Marketing*:** Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle., Channels of distribution.

Unit V

Human Resources Management (HRM): Evolution of HRM, Concepts of HRM, Basic functions of HR Manager: Manpower planning, Recruitment,

Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

Unit VI

***Project Management (PERT/CPM)*:** Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

Unit VII

***Strategic Management*:** Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

Unit VIII

***Contemporary Management Practices*:** Basic concepts of Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levels, Value Chain Analysis,Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering 5S Model, Deming's PDCA, Kaizen, Poka-Yoke, Muda, Benchmarking, Balanced Score Card.

TEXT BOOK:

1. Aryasri: *Management Science*, TMH, New Delhi, 2009

REFERENCE BOOKS:

1. Stoner, Management, Pearson, 2009
2. Kotler Philip & Keller Kevin Lane: Marketing Management PHI, 2009.
3. Koontz, Weihrich, & Aryasri: Principles *of Management*, TMH, 2009.
4. Thomas N.Duening & John M.Ivancevich *Management—Principles and Guidelines,* Cengage, 2009.
5. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2009.
6. Memoria & S.V.Ganker, *Personnel Management*, Himalaya, 2009
7. Schermerhorn: *Management*, Wiley, 2009.

8. Parnell: Strategic Management, Biztantra, 2009.

9. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2009.

10. William J. Stevenson & Ceyhun Ozgur: Introduction to Management Science, TMH, 2007.

Pre-requisites: Managerial Economics

***Objective*:** To familiarize with the process of management and to provide basic insights into select contemporary management practices.

Codes/Tables: Normal Distribution Function Table need to be permitted into the examination Hall.

Question Paper Pattern: 5 Questions to be answered out of 8 questions. The question paper should contain atleast

2 practical problems, one each from units –III & VI

Each question should not have more than 3 bits.

Unit VIII will have only short questions, not essay questions.

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(55067) FLIGHT MECHANICS – II

UNIT-I

AIRCRAFT IN EQUILIBRIUM FLIGHT- ELEVATOR ANGLE AND STICK FORCES TO TRIM- LONGITUDINAL STATIC AND MANEUVER STABILITY-I

Need for controlled flight- aircraft mission profile- means of control- task of pilot, aircraft handling qualities.

Equilibrium, stability, control, trim- definitions- examples from simple mechanical systems. Longitudinal forces and moments on aircraft in unaccelerated flight- contribution of principal components. Equations of equilibrium- thrust, angle of attack, elevator angle required to trim. Control gradient, airplane lift curve slope and pitch stiffness. Tailless aircraft and aircraft with foreplanes.

Effect of flaps and flight speed on force and moment coefficients, velocity derivatives. Longitudinal static stability- definition, relation to control gradient, pitch stiffness. Stick fixed neutral point- static margin. Equivalence of neutral point and aircraft aerodynamic centre- validity.

UNIT-II

AIRCRAFT IN EQUILIBRIUM FLIGHT- ELEVATOR ANGLE AND STICK FORCES TO TRIM- LONGITUDINAL STATIC AND MANEUVER STABILITY-II

Equations of motion in steady, symmetric pull-up maneuvers and coordinated turns- pitch rate, pitch damping. Control to trim, control gradient- maneuver point, maneuver margin- relation to static margin.

Trim curves- trim and control of highly stable, marginally stable and unstable aircraft- safety implications. Effect on pilot's task. Statutory limits on forward-most and aft-most positions of centre of gravity. Determination of neutral and maneuver points by flight testing.

Elevator hinge moments, coefficients- relation to control stick forces. Hinge moment derivatives. Stick force to trim in symmetric unaccelerated flight, maneuvering flight. Stick force gradients- effect of trim speed- role of trim tab. Effect of freeing elevator on tail effectiveness, static and maneuver

stability. Elevator-free factor. Stick-free neutral and maneuver points, stability margins- relation with stick force gradients. Aerodynamic and mass balancing of control surfaces. Control tabs- types, function, construction.

UNIT-III

LATERAL-DIRECTIONAL STATIC STABILITY AND TRIM

Lateral-directional motions, aerodynamic forces and moments, coupling- aircraft side force, rolling moment and yawing moment, due to side slip, aileron and rudder- static aerodynamic derivatives. Contribution of vertical tail, side wash rate, wing dihedral, sweep, position on fuselage- high angle of attack operations. Lateral-directional stability requirements, aileron, rudder control powers, adverse aileron yaw. Gravity forces.

Equilibrium of forces and moments. Aileron, rudder, elevator and thrust required to trim aircraft in steady sideslip, roll, coordinated turn, engine out condition. Cross wind landings.

UNIT-IV

ESTIMATION OF AERODYNAMIC FORCE AND MOMENT DERIVATIVES OF AIRCRAFT

Significance of aerodynamic derivatives. Derivatives of axial, normal force components and pitching moment with respect to the velocity, angle of attack, angle of attack rate, pitch rate, elevator angle. Derivatives of side force, rolling and yawing moments with respect to the angle of sideslip, rate of sideslip, roll rate, yaw rate, aileron, rudder deflections- dependence on vehicle geometry, flight configuration- estimation- the strip theory method. Lateral and directional stability, roll and yaw damping, aileron and rudder power, the cross derivatives. Relation between dimension-less and dimensional aerodynamic derivatives.

UNIT-V

AIRCRAFT EQUATIONS OF MOTION

Description of motion of flight vehicle- systems of reference frames- earth, body, wind, stability axes- relative merits. Euler angles, angles of attack and sideslip– definitions- earth to body axis transformation, stability axis to body axis transformation. Rotating axis system- expressions for linear and angular momenta of rigid body, time derivatives- inertia tensor, components of linear and angular velocities, accelerations. Components of aerodynamic, gravity forces, moments applied on flight vehicle. Equations of motion- longitudinal

and lateral-directional. Relation between angular velocity components and Euler angle rates. Determination of velocities of airplane in earth axis system. Determination of vehicle trajectory- outline of method.

UNIT-VI

PERTURBED MOTION- LINEARISED, DECOUPLED EQUATIONS OF MOTION OF AIRCRAFT

Description of state of motion of vehicle, forces and moments as perturbations over prescribed reference flight condition. Equation of motion in perturbation variables. Assumption of small perturbations, first order approximations- linearised equations of motion. Decoupling- conditions for validity, role of symmetry. Linearised longitudinal and lateral-directional equations of perturbed motion.

UNIT-VII

AIRCRAFT DYNAMIC STABILITY- LONGITUDINAL

Review of solutions of first and second order ordinary differential equations. - time constant, undamped natural frequency and damping ratio. Linearised longitudinal equations of motion of aircraft - three degree of freedom analysis- solutions- ,principal modes of motion- characteristics. Mode shapes- significance. Two degree of freedom constant speed approximation, constant angle of attack approximation, one degree of freedom approximations- solutions- comparison with three degree of freedom solutions- justification of approximations.

UNIT-VIII

AIRCRAFT DYNAMIC STABILITY- LATERAL-DIRECTIOAL

Lateral directional equations- three degree of freedom analysis, principal modes- characteristics- mode shapes- significance, lower order analysis- approximate solutions. Determination of longitudinal and lateral stability from coefficients of characteristic equation- stability criteria, approximate roots. Special problems in aircraft dynamics- roll coupling, high angle of attack operation. Aircraft spin- entry, balance of forces in steady spin, recovery, pilot techniques.

TEXT BOOKS

1. Yechout, T.R. et al., *Introduction to Aircraft Flight Mechanics*, AIAA education Series, 2003, ISBN 1-56347-577-4.

2. Nelson, R.C., *Flight Stability and Automatic Control*, 2nd edn., Tata McGraw Hill, 2007, ISBN 0-07-066110-3.

REFERENCES

1. Etkin, B. and Reid, L.D., *Dynamics of Flight*, 3rd edn., John Wiley, 1998, ISBN 0-47103418-5.

2. Schmidt, L.V., *Introduction to Aircraft Flight Dynamics*, AIAA Education Series, 1998, ISBN A-56347-226-0.

3. McCormick, B.W., *Aerodynamics, Aeronautics, and Flight Mechanics*, 2nd edn., Wiley India, 1995, ISBN 978-

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(55068) AERODYNAMICS – II

Tables and charts required to be supplied to candidates for reference during examination:

1. *Tables:*

- *1. Isentropic Flow Properties, 2. Normal Shock Properties, 3. Prandtl – Meyer Function and Mach Angle, 4. One Dimensional Flow with Heat Addition, 5. One Dimensional Flow with Friction, 6. Properties of International Standard atmosphere and*

1. *Chart:*

- *7. Oblique Shock Properties.*

UNIT–I

COMPRESSIBLE FLOWS

Definition of compressibility of flow, measure, flow regimes. Review of thermodynamics - internal energy and enthalpy, first law of thermodynamics, entropy and second law, isentropic relations. Governing equations for inviscid compressible flow- speed of sound, stagnation conditions. Special forms of energy equation.

UNIT–II

ONE-DIMENSIONAL FLOWS

Governing equations, speed of sound and Mach number, forms of energy equation, Normal shock waves, basic equations, Hugoniot equation, calculation of normal shock wave properties, measurement of air speed in compressible subsonic and supersonic flows. One-dimensional flow with heat addition, friction- thermal and friction choking.

UNIT–III

OBLIQUE SHOCK AND EXPANSION WAVES

Oblique shock relations, supersonic flow over wedges and cones, shock polar, regular reflections from solid boundary, pressure deflection diagrams, intersection of shocks, Mach reflection, detached shock wave in front of a

bluff body, three dimensional shock waves, Prandtl-Meyer expansion waves, shock expansion theory- application to supersonic airfoils. Viscous boundary layer - effects of compressibility, shock-boundary layer interactions.

UNIT–IV

QUASI-ONE DIMENSIONAL COMPRESSIBLE FLOWS

Adiabatic flow in straight, variable area channels- nozzles, diffusers. Governing equations, area-velocity relation. Mass flow rate, effect of stagnation conditions, back pressure. Choked flow- isentropic flow, ideally expanded, over-expanded, under-expanded flows- appearance of normal shock- flow losses. Wave reflection from free boundary, Operation of supersonic wind tunnels.

UNIT–V

SUBSONIC AND TRANSONIC COMPRESSIBLE FLOWS

The velocity potential, perturbation potential, governing equation of flow-linearization. The pressure coefficient- Prandtl-Glauert compressibility correction, application to swept wings, improved compressibility corrections, second order theory, critical Mach no., drag divergence Mach no., the sound barrier. Supercritical airfoils, swept wings at transonic speeds, wing-body interactions, area rule, forward swept wings, transonic aircraft.

UNIT–VI

LINEARISED SUPERSONIC FLOWS

Linearised supersonic flow- governing equations, boundary conditions. Pressure coefficient, application to supersonic airfoils. Lift, drag, pitching moment, symmetric and asymmetric double wedge and biconvex airfoils. General airfoil section, Second order theory, shock expansion technique. Supersonic airfoils. Flow, airloads over wings of finite span- supersonic leading edge and subsonic leading edge, delta wings. Method of characteristics- application to supersonic nozzle design.

UNIT-VII

SUPERSONIC FLOW OVER WINGS AND AIRPLANE CONFIGURATIONS

Three dimensional supersonic flow- governing equation and boundary conditions, consequences of linearity, solution methods- conical flow method – rectangular, swept, delta and arrow wings. Singularity distribution method.

Design considerations for supersonic aircraft, aerodynamic interaction. Aerodynamic analysis of complete aircraft configurations in supersonic stream. Effect of Mach number on zero lift drag of two and three dimensional shapes.

UNIT–VIII

HYPERSONIC FLOWS

Qualitative aspects of hypersonic flow, hypersonic shock wave relations, Newtonian flow model, stagnation region flow properties, modified Newtonian flow. Lift and drag of flat plate wings at hypersonic speeds. Hypersonic shockwave relations- Mach no. independence, law of hypersonic similarity. High L/D hypersonic configurations – wave riders. Aerodynamic heating.

TEXT BOOKS

1. Bertin, J.J., *Aerodynamics for Engineers*, 4th edn., Indian reprint, Pearson Education, 2004, ISBN: 81-297-0486-2
2. Anderson, J.D., *Modern Compressible Flow with Historical Perspective*, 3rd edn., McGraw-Hill, 2003, ISBN: 0-07-112161-7.
3. Kroo I.,*Applied Aerodynamics: A Digital Textbook*, Desktop Aeronautics Inc., http://www.desktopaero.com/appliedaero/preface/welcome.html

REFERENCES

1. Liepmann, H.W., and Roshko, A., *Elements of Gas Dynamics*, John Wiley, 1957.
2. McCormick, B.W., *Aerodynamics, Aeronautics & Flight Mechanics*, 2nd edn., John Wiley, 1995, ISBN: 0-471-57506-2.
3. Shapiro, A.H., *The Dynamics and Thermodynamics of Compressible Fluid Flow, Vols. I and II*, John Wiley, 1953.
4. Landau, L.D., & Lifshitz, E.M., *Fluid Mechanics*, 2nd edn., Course of Theoretical Physics, vol. 6, Maxwell Macmillan International Edition, Pergamon, 1989, ISBN: 0-02-946234-7.

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(55069) AEROSPACE VEHICLE STRUCTURES- II

UNIT- I

THIN PLATE THEORY- THIN PLATES SUBJECTED TO BENDING, TORSION, TRANSVERSE AND IN-PLANE LOADING

Analysis of thin rectangular plates subject to bending, twisting, distributed transverse load, combined bending and in-plane loading- thin plates having small initial curvature, energy methods of analysis.

UNIT- II

STRUCTURAL INSTABILITY- BUCKLING OF THIN PLATES AND STIFFENED PANELS

Buckling of thin plates- elastic, inelastic, experimental determination of critical load for a flat plate, local instability, instability of stiffened panels, failure stresses in plates and stiffened panels. Tension field beams- complete diagonal tension, incomplete diagonal tension, post buckling behaviour.

UNIT- III

BENDING AND SHEAR OF THIN WALLED BEAMS

Review of symmetrical bending of beams, unsymmetrical bending- resolution of bending moments, direct stress distribution, position of neutral axis. Deflections due to bending- approximations for thin walled sections, temperature effects.

Shear loaded thin walled beams- general stress, strain and displacement relationships- direct stress and shear flow system- shear centre, twist and warping.

UNIT- IV

TORSION OF THIN WALLED BEAMS

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

UNIT- V

STRUCTURAL IDEALISATION OF THIN WALLED BEAMS

Structural idealization- principal assumptions, idealization of panel, effect on the analysis of thin walled beams under bending, shear, torsion loading- application to determining deflection.

UNIT- VI

STRUCTURAL AND LOADING DISCONTINUITIES IN THIN WALLED BEAMS

Closed section beams- shear stress distribution of a closed section beam built in at one end under bending, shear and torsion loads.

Open section beams- I section beam subjected to torsion, torsion of beam of arbitrary section, torsion bending constant, distributed torque loading- extension of theory for general systems of loading.

Shear lag- effect of shearing strains in beams- redistribution of bending stresses due to restraining of warping, limitation of elementary bending theory, effect of accounting for shear lag on the estimated strength.

UNIT- VII

STRESS ANALYSIS OF AIRCRAFT COMPONENTS- WING

Wing spars and box beams- tapered wing spar, open and closed section beams, beams having variable stringer areas. Wings- Three-boom shell in bending, torsion, shear, tapered wings, deflections, cut-outs in wings.

UNIT- VIII

STRESS ANALYSIS OF AIRCRAFT COMPONENTS- FUSELAGE

Bending, shear, torsion, cut-outs in fuselages. Fuselage frames and wing ribs- principles of stiffener/ web construction, fuselage frames, wing ribs.

TEXT BOOKS

1. Megson, T.H.G., *Aircraft Structures for Engineering Students*, 4th edn., Elsevier, 2007, ISBN 0-750-667397.

2. Peery, D.J. and Azar, J.J., *Aircraft Structures*, 2nd edn., McGra-Hill, 1982, ISBN 0-07-049196-8.

REFERENCES

1. Allen, D.H. and Haisler, W.E., *Introduction to Aerospace Structural Analysis*, John Wiley, 2010.
2. Niu, M.C., *Airframe Analysis and Sizing*, 2nd edn., Hongkong Conmilit Press, 1999, ISBN 962-7128-08-2.
3. Niu, M.C., *Airframe Structural Design*, 2nd edn., Hongkong Conmilit Press, 2002, ISBN 962-7128-09-0.
4. Bruhn. E.H, *Analysis and Design of Flight Vehicles Structures*, Tri-state Off-set Company, USA, 1965.
5. Lakshmi Narasaiah, G., *Aircraft Structures*, BS Publications, 2010.
6. Rivello, R.M., *Theory and Analysis of Flight Structures*, McGraw Hill, 1993.
7. Sechler.E.E. and Dunn, L.G., *Airplane Structural Analysis and Design*, John Wiley & Sons.

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(55070) AEROSPACE PROPULSION- I

UNIT-I

FLIGHT PROPULSION- AIRCRAFT GAS TURBINE ENGINES- GENERATION OF THRUST- ENGINE PERFORMANCE PARAMETERS

History of flight propulsion. Role of reciprocating engines. Operating envelope of flight vehicles. Engine operational limits. Air breathing engines- types. Aircraft gas turbine engines- types, operating principles, distinguishing features- schematic diagrams, relative merits, applications. Engine components- function, schematic diagram, layout, engine station numbering. Thrust generation- momentum equations. Gross, net, uninstalled, installed thrust, propulsive efficiency. Engine performance parameters- specific thrust, specific fuel consumption, total efficiency- performance trends. Effect of flight conditions, jet exit speed, exit pressure. Role of propulsion in aircraft performance. Criteria for engine selection, airframe-engine matching.

UNIT-II

AEROTHERMODYNAMIC MODELING OF ENGINE AND COMPONENTS

Engine components- performance requirements, thermodynamic processes- change of state- representation by T-s and p-v diagrams - pressure ratios, temperature ratios. Energy transfer, losses- entropy generation- mechanisms. Performance- polytropic, stage and component efficiencies, burning efficiency, under and over expansion- interrelations- effect of variable specific heats, figures of merit- significance- ideal component characteristics.

Aircraft gas turbine engines- cycle representation- turbojet, turbojet with reheat, turbofan- identification of engine components in the cycle. Computation of net work, thermal efficiency- application to thrust equation- expression of engine performance parameters in terms temperature and pressure ratios- degeneration for ideal engine- significance.

Engine design choice parameters- compressor pressure ratio, bypass ratio, fan pressure ratio, split ratio, jet velocity ratio; design constraints- turbine inlet temperature, engine speed; flight conditions- ambient pressure and temperature, flight Mach number; engine operating parameters- mass flow rate, burner total temperature ratio – significance, interrelations.

UNIT-III

PARAMETRIC CYCLE ANALYSIS OF ENGINES

Parametric cycle analysis- definition, purpose- determination of engine performance parameters- effect of component performance, engine design choices, design constraints, flight conditions, operating parameters- performance trends, optimization, optimized performance, determination of engine design point, design point performance.

Parametric cycle analysis of ideal engines- need, assumptions, procedure for ideal turbojet, turbofan- optimal compressor pressure ratio, bypass ratio, fan pressure ratio. Real turbojet engine with component losses, performance trends- comparison with ideal cycle analysis.

UNIT-IV

AIRCRAFT ENGINE COMPONENTS- NON-ROTATING- INLETS AND EXHAUST NOZZLES

Subsonic inlets- function, performance requirements, geometry, operating conditions, flow field, capture area, sizing. Flow distortion, inlet drag, nacelle and interference drag, diffuser losses- methods for mitigation. Performance- pressure ratio, total pressure ratio, isentropic efficiency. Supersonic inlets- compression process, types, construction, losses, performance characteristics.

Exhaust nozzles- primary nozzle, fan nozzle- governing equations of flow-choking, engine back pressure control, nozzle-area ratio, thrust reversing, vectoring- mechanisms. Performance- gross thrust coefficient, discharge coefficient, velocity coefficient, angularity coefficient, performance maps.

UNIT-V

NON-ROTATING COMPONENTS- COMBUSTION SYSTEMS- COMBUSTORS, AFTERBURNERS, DUCTS AND MIXERS

Combustors- desirable properties. Combustion process- reaction rate, flammability characteristics, stability- effects of fuel-air mixture ratio, mass flow rate, combustor volume, pressure. Combustion loading parameter, sizing of combustor. Combustion system total pressure ratio- 1-D modeling of flow.

Burners- types, components- function, schematic diagram, airflow distribution, cooling- types, cooling effectiveness. Combustor performance parameters- combustion efficiency, overall total pressure loss, exit temperature profile, ignition relight envelope- effect of combustor design. Fuel injection,

atomisation, vaporisation, recirculation- flame stabilisation, flame holders. Afterburners, function, components, design requirements, design parameters. The bypass duct- total pressure losses. Mixing process- pressure losses. Aircraft gas turbine engine fuels- composition, specifications of commonly used fuels.

UNIT-VI

ROTATING MACHINERY- AXIAL FLOW COMPESSORS

Operating principle, description of flow field. Construction- stages, stators, rotors, cascades of blades, repeating stages- geometry, layout, cascade- blade geometry- solidity, stagger angle, airfoil angle settings, angle of incidence, exit deviation angles, flow angles, hub-tip ratio- interrelations, design considerations.

Flow analysis- Euler's turbo-machinery equations, use of absolute and cascade relative coordinate system. Velocity diagram analysis. Stage parameters- degree of reaction, stage loading and flow coefficients, pressure and temperature ratios, blade Mach number- significance, interrelations. Flow losses- causes- diffusion, polytropic efficiency, stage efficiency- relation to total pressure loss coefficient.

Computation of stage and component parameters for compressor of given cascade-blade geometry, inlet flow conditions and engine speed- procedure. Operation at off design speeds, compressor maps - flow problems- surge, separation, rotating stall, windmilling- solutions. Estimation of flow annulus area. Significance of 50% reaction design.

Variable stators, multi-spool design- need, constraints. Limits on achievable compressor performance- losses, blade stresses. Range of axial flow compressor design parameters. Typical compressor blade profiles.

UNIT-VII

ROTATING MACHINERY- AXIAL FLOW TURBINES

Axial flow turbines- similarities and differences with compressors. Velocity diagram analysis- no exit swirl condition, flow losses- causes- tangential stresses, repeating stages. Computation of stage parameters for ideal and real turbine of given cascade–blade geometry and initial flow conditions and turbine speed- procedure. Typical turbine blade profiles, turbine performance maps. Thermal limits of blades- cooling, materials, construction, methods of production. Limits on stage pressure ratio of turbines- multistage, multi-

spooled turbines. Range of axial flow turbine design parameters. Typical turbine blade profiles.

UNIT- VIII

PERFORMANCE ANALYSIS- COMPONENT MATCHING

Nondimensionalisation and correction of engine and component characteristic parameters- merits- corrected performance. Performance analysis of compressor, fan, burner, turbine, exhaust nozzle. Relation between compressor pressure ratio, mass flow rate, efficiency, engine speed. Engine control- throttle lever setting, fuel flow, burner temperature ratio, turbine speed, flow coefficient, mass flow rate- relations. Off design performance of compressor- compressor operating line- significance, application to engine performance analysis. Engine thrust ratings.

Component matching- significance, requirements, simplifying assumptions- choked turbine and exhaust nozzle flow, constant component efficiencies. Turbine inlet temperature as control parameter. Engine working lines. Effect of exhaust nozzle area, turbine inlet vane. Component matching for gas generator, turbo jet engine. Engine performance maps. Use of matching data to second stage design. Review of aircraft-engine matching.

TEXT BOOKS

1. Mattingly, J.D., *Elements of Gas Turbine Propulsion*, McGraw-Hill, 1996, ISBN0-07-912196-9.
2. Flack, R.D., *Fundamentals of Jet Propulsion with Applications*, Cambridge University Press, 2005, ISBN 0-521-81983-0.
3. Oates, G.C., ed., *Aerothermodynamics of Aircraft Engine Components*, AIAA, 1985, ISBN 0-915928-97-3.
4. *The Jet Engine*, Rolls Royce plc, 1986, ISBN 0-902121-2-5.

REFERENCES

1. Cumpsty, N., *Jet Propulsion*, 2nd edn., Cambridge University Press, 2005, ISBN 0-521-54144-1.
2. Kerrebrock, J.L., *Aircraft Engines and Gas Turbines*, 2nd edn. , MIT Press, 1992, ISBN 0-262-11162-4.
3. Hill, P.G. and Peterson, C.R., *Mechanics and Thermodynamics of Propulsion*, 2nd edn. , Addison Wesley, 1992.

4. Saravanamuttoo, H.I.H., Rogers, G.F.C. and Cohen, H., *Gas Turbine Theory*, 5th edn., Prentice Hall, 2001.
5. El-Sayed, A.F., *Aircraft Propulsion and Gas Turbine Engines*, CRC Press, 2008, ISBN 978-0-8493-9196-5.
6. Boyce, M.P., *Gas Turbine Engineering Handbook*, 2nd edn., Gulf Professional Publishing, 2002, ISBN 0-88415-732-6.
7. *The Aircraft Gas Turbine Engine and Operation*, Pratt& Whitney, 1988.

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(55071) AIR TRANSPORTATION SYSTEMS

UNIT-I

AVIATION INDUSTRY

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

UNIT-II

NATURAL ENVIRONMENT

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

UNIT-III

REGULATORY ENVIRONMENT

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

UNIT-IV

OPERATIONAL ENVIRONMENT

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

UNIT-V

AIRCRAFT

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

UNIT-VI

AIRLINES

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

UNIT-VII

AIRPORTS

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

UNIT-VIII

AIRSPACE

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

TEXT BOOK

1. Hirst, M., *The Air Transport System*, Woodhead Publishing Ltd, Cambridge, England, 2008.

REFERENCES

1. Wensven, J.G., *Air Transportation: A Management Perspective*, Ashgate, 2007.
2. Belobaba, P., Odoni, A. and Barnhart, C., *Global Airline Industry*, Wiley, 2009.
3. M. Bazargan, M., *Airline Operations and Scheduling*, Ashgate, 2004.
4. Nolan, M.S., *Fundamentals of Air Traffic Control*, 4th edn., Thomson Learning, 2004.
5. Wells, A. and Young, S., *Airport Planning and Management*, 5th edn., McGraw-Hill, 1986.

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(55629) AEROSPACE STRUCTURES LAB

EXERCISES

1. Study of construction and use of Universal Testing Machine, mechanical and optical extensometers- application to determine stress-strain curves and tensile and compressive strength of various engineering materials.
2. Bending tests- deflection of slender and short beams for various loading and end conditions- determination of influence coefficients- verification of Maxwell's and Castigliano's theorems.
3. Compression tests on long and short columns- determination of buckling loads– Southwell plot.
4. Determination of the strength and deformation of riveted and bolted joints.
5. Methods of inspection and non-destructive testing (NDT) of aircraft structural components.
6. Strain gauge techniques- measurement of strain in beams, thin and thick walled cylinders subjected to internal pressure, shaft subjected to combined loading.
7. Shear Centres of open and closed sections- determination of the elastic axis of beams.
8. Post buckling behavior of shear panels- measurements on semi-tension field webs of beams.
9. Determination of elastic constants of composite materials- flexural test on composites.
10. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
11. Study and use of seismic pickups for the measurement of amplitude and frequency of vibration of structural components.
12. Determination of critical fracture toughness of aerospace materials.

REFERENCE BOOKS

1. Megson, T.H.G., *Aircraft Structures for Engineering Students*, 4th edn., Elsevier, 2007, ISBN 0-750-667397.
2. Bruhn. E.H, *Analysis and Design of Flight Vehicles Structures*, Tri-state Off-set Company, USA, 1965.

EQUIPMENT REQUIRED

1. UTM- 20/ 40 tonnes- with requisite jigs and fixtures for compression and tensile tests and precision extensometers.
2. Beam deflection test rigs with requisite precision dial gages.
3. Test rig for determination of shear centre.
4. NDT equipment for a) Ultrasonic testing, b) Magnetic particle testing, c) Dye penetration test.
5. Strain measuring equipment: a) various electrical resistance strain gages and rosettes, b) Multi-channel strain measuring equipment.
6. Experimental rigs and set-ups required for conducting specific tests.

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(55630) AERODYNAMICS AND PROPULSION LAB

AERODYNAMICS LAB

1. Fluid flow studies using blower
2. Calibration of low speed wind tunnel
3. Drag of different bodies
4. Pressure distribution studies on two-dimensional models
5. Pressure distribution over an airfoil at different angles of attack
6. Aerodynamic characterization of NACA - 0012 airfoil
7. Axial Flow Compressor
8. Centrifugal Flow Compressor
9. Flow visualization techniques

PROPULSION LAB

1. Study of piston engine (Valve timing and port timing diagram)
2. Stripping of a piston engine, visual inspection and reasoning for common troubles and trouble-shooting
3. Performance of piston engine
4. Heat balancetest on piston engine
5. Engine balancing
6. Characterization of aviation fuels

EQUIPMENT REQUIRED

1. Low Speed Wind-Tunnel Test Rig with a test section of 1 meter X 1 meter with necessary accessories.
2. Test Rig for Axial Flow Compressor
3. Test Rig for Centrifugal Flow compressor.
4. Heat Engine Test Rig.
5. Balancing Test Rig
6. Calorimeter Apparatus
7. Piston Engine

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III Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
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(56070) COMPUTATIONAL AERODYNAMICS

UNIT-I

BASIC ASPECTS OF COMPUTATIONAL AERODYNAMICS

Why Computational Fluid Dynamics? What is CFD? CFD as a research tool- as a design tool. Applications in various branches of engineering. - Models of fluid flow- Finite Control Volume, Infinitesimal Fluid Element. Substantial derivative- physical meaning of Divergence of velocity.

UNIT-II

GOVERNING EQUATIONS AND PHYSICAL BOUNDARY CONDITIONS

Derivation of continuity, momentum and energy equations- physical boundary conditions- significance of conservation and non-conservation forms and their implication on CFD applications- strong and weak conservation forms- shock capturing and shock fitting approaches.

UNIT-III

MATHEMATICAL BEHAVIOR OF PARTIAL DIFFERENTIAL EQUATIONS AND THEIR IMPACT ON COMPUTATIONAL AERODYNAMICS

Classification of quasi-linear partial differential equations by Cramer's rule and eigen value method. General behaviour of different classes of partial differential equations and their importance in understanding physical and CFD aspects of aerodynamic problems at different Mach numbers involving hyperbolic, parabolic and elliptic equations- domain of dependence and range of influence for hyperbolic equations. Well-posed problems.

UNIT-IV

BASIC ASPECTS OF DISCRETIZATION

Introduction to finite differences- finite difference approximation for first order, second order and mixed derivatives. Pros and cons of higher order difference schemes. Difference equations- explicit and implicit approaches- truncation and round-off errors, consistency, stability, accuracy, convergence, efficiency of numerical solutions-Von Neumann stability analysis. Physical significance of CFL stability condition.

UNIT-V

FINITE VOLUME METHODS

Basis of finite volume method- conditions on the finite volume selections- cell-centered and cell-vertex approaches. Definition of finite volume discretization-general formulation of a numerical scheme- two-dimensional finite volume method with example.

UNIT-VI

GRID TYPES AND CHARACTERISTICS

Need for grid generation. Structured grids- Cartesian grids, stretched (compressed) grids, body fitted structured grids, H-mesh, C-mesh, O-mesh, I-mesh, Multi-block grids, C-H mesh, H-O-H mesh, overset grids, adaptive grids. Unstructured grids- triangular/ tetrahedral cells, hybrid grids, quadrilateral/ hexahedra cells.

UNIT-VII

CFD TECHNIQUES-I

Lax-Wendroff technique, MacCormack's technique-Crank Nicholson technique-Relaxation technique- aspects of numerical dissipation and dispersion. Alternating-Direction-Implicit (ADI) Technique.

UNIT-VIII

CFD TECHNIQUES-II

Pressure correction technique- application to incompressible viscous flow- need for staggered grid. Philosophy of pressure correction method- pressure correction formula. Numerical procedures- SIMPLE, SIMPLER, SIMPLEC and PISO algorithms. Boundary conditions for the pressure correction method.

TEXT BOOKS

1. Anderson, J.D., Jr., *Computational Fluid Dynamics- The Basics with Applications*, McGraw-Hill Inc., 1995.
2. Anderson, D.A., Tannehill, J.C., Pletcher, R.H., *Computational Fluid Mechanics and Heat Transfer*, Second Edition, Taylor and Francis, 1997.

REFERENCES

1. Hirsch, C., *Numerical Computation of Internal and External Flows-Fundamentals of Computational Fluid Dynamics*, Second Edition, Elsevier, 2007.

2. Versteeg, H.K. and Malalasekera, W., *An Introduction to Computational Fluid Dynamics-The Finite Volume Method,* Second Edition, Pearson Education Ltd, 2010

3. Tu, J., Yeoh, G.H., Liu, C., *Computational Fluid Dynamics-A Practical Approach,* Butterworth-Heinemann, 2008.

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III Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	4	**1/-/-**	**4**

(56071) CONCEPTUAL DESIGN OF FLIGHT VEHICLES

UNIT–I

OVERVIEW OF THE DESIGN PROCESS, SIZING FROM A CONCEPTUAL SKETCH

Phases of aircraft design. Aircraft conceptual design process, project brief / request for proposal, problem definition, information retrieval, aircraft requirements, configuration options. Integrated product development and aircraft design.

The initial conceptual sketches, L / D estimation. Initial takeoff weight build-up, empty weight estimation – historical trends, fuel fraction estimation, mission profiles, mission segment weight fractions.

UNIT–II

AIRFOIL AND GEOMETRY SELECTION, THRUST TO WEIGHT RATIO, WING LOADING

Airfoil selection, airfoil design, design lift coefficient, stall, airfoil thickness ratio and other airfoil considerations. Wing geometry and wing vertical location, wing tip shapes. Tail geometry and arrangements.

Thrust to weight ratio - statistical estimation, thrust matching. Wing loading – performance constraints. Selection of thrust-to-weight ratio and wing loading.

UNIT–III

INITIAL SIZING & CONFIGURATION LAYOUT, CREW STATION, PASSENGERS & PAYLOAD

Sizing with fixed engine and with rubber engine. Geometry sizing of fuselage, wing, tail, control surfaces.

Development of configuration lay out from conceptual sketch. The inboard profile drawing, wetted area, volume distribution and fuel volume plots. Lofting- definition, significance and methods, flat wrap lofting.

Special consideration in configuration lay out. Isobar tailoring, Sears-Haack volume distribution, structural load paths. Radar, IR, visual detectability,

aural signature. Considerations of vulnerability, crashworthiness, producibility, maintainability.

Fuselage design- crew station, passenger compartment, cargo provisions, weapons carriage, gun installation.

UNIT– IV

PROPULSION & FUEL SYSTEM INTEGRATION, LANDING GEAR & SUBSYSTEMS

Propulsion selection, jet engine integration, engine dimensions, inlet geometry, inlet location, capture area calculation, boundary layer diverters, nozzle integration, engine cooling provisions, engine size estimation. Fuel system design and integration.

Landing gear arrangements, guidelines for lay out. Shock absorbers – types, sizing, stroke determination, gear load factors. Gear retraction geometry. Aircraft subsystems, significance to configuration lay out. The baseline design layout and report of initial specifications.

UNIT– V

BASELINE DESIGN ANALYSIS- AERODYNAMICS & PROPULSION, STRUCTURES & WEIGHT AND BALANCE

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

UNIT– VI

BASELINE DESIGN– STABILITY & CONTROL, PERFORMANCE AND CONSTRAINT ANALYSIS

Estimation of static pitch stability, velocity stability and trim. Estimation of stability and control derivatives. Static lateral-directional stability & trim. Estimation of aircraft dynamical characteristics, handling qualities. Cooper – Harper scale, relation to aircraft dynamic characteristics.

Performance analysis and constraint analysis– steady level flight, minimum thrust required for level flight, range and loiter endurance. Steady climbing

and descending flight, best angle and rate of climb, time to climb and fuel to climb. Level turning flight, instantaneous turn rate, sustained turn rate. Energy manoeuvrability methods of optimal climb trajectories and turns. The aircraft operating envelope. Take off analysis, Balanced field length. Landing analysis. Fighter performance measures of merit. Effects of wind on aircraft performance.

Initial technical report of baseline design analysis and evaluation. Refined baseline design and report of specifications.

UNIT- VII

COST ESTIMATION, PARAMETRIC ANALYSIS, OPTIMISATION, REFINED SIZING & TRADE STUDIES

Elements of life cycle cost, cost estimating method, RDT&E and production costs, operation and maintenance costs, fuel and oil costs, crew salaries, maintenance expenses, depreciation. Cost measures of merit. Aircraft and airline economics, DOC and IOC, airline revenue, breakeven analysis, investment cost analysis.

Parametric analysis and optimisation. Refined conceptual sizing methods. Sizing matrix plot and carpet plot. Trade studies - design trades, requirement trades, growth sensitivities. Multivariable design optimisation methods. Measures of merit.

Determination of final baseline design configuration, preparation of type specification report.

UNIT– VIII

CASE STUDIES AND DESIGN OF UNIQUE AIRCRAFT CONCEPTS

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

TEXT BOOKS

1. Raymer, D.P., *Aircraft Design: A Conceptual Approach*, 3rd edn., AIAA Education Series, AIAA, 1999, ISBN: 1-56347-281-0.
2. Howe, D., *Aircraft Conceptual Design Synthesis*, Professional Engineering Publishing, London, 2000, ISBN: 1-86058-301-6.

3. Fielding, J.P., Introduction to Aircraft Design, Cambridge University Press, 2005, ISBN: 0-521-657222-9.

REFERENCES

1. *AIAA Aerospace Design Engineer's Guide*, 5th edn., AIAA Education Series, 2003, ISBN 1-56347-590-1.

2. Jenkinson, L.R. and Marchman III, J. F., *Aircraft Design Projects for Engineering Students*, Butterworth Heinemann, 2003, ISBN: 0 7506 57723.

3. Brandt, S.A. et. al., *Introduction to Aeronautics: A Design Perspective*, 2nd edn., AIAA Education Series, AIAA, 2004, ISBN: 1-56347-701-7

4. Anderson, J.D. Jr., *Aircraft Performance and Design*, McGraw-Hill, 1999, ISBN: 0-07-001971-1.

5. Dole, C.E., *Flight Theory and Aerodynamics: A Practical Guide to Operational Safety*, Wiley, 1981, ISBN: 0-471-09152-9

6. Taylor, J., *Jane's All the World Aircraft*, latest edition, Jane's, London.

7. Stinton, The Design of the Airplane, second edition, AIAA, 2001, ISBN: 0-56347-524-6.

8. Kroo I., *Applied Aerodynamics: A Digital Textbook*, Desktop Aeronautics Inc., http://www.desktopaero.com/appliedaero/preface/welcome.html

9. Keane, A.J. And Nair, P.B., *Computational Approaches for Aerospace Design*, Wiley, 2005, ISBN:0-470-85540-1.

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III Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
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(56072) AEROSPACE PROPULSION- II

UNIT-I

TRANS-ATMOSPHERIC AND SPACE FLIGHT MISSION PROPULSION REQUIREMENTS- PROPULSION SYSTEMS- CLASSIFICATION, PERFORMANCE CHARACTERISTICS

Hypersonic transport vehicles, military missiles, space launch vehicles, spacecraft- role, types, missions- profile, trajectories, operating conditions- gravity, atmosphere. Incremental flight velocity budget for climb out and acceleration, orbital injection- Breguet equation for cruise– mission propulsion requirements- thrust levels, burnig time, economy.

High speed propulsion systems- types, construction, operating principles- sources of energy, generation of power, momentum, propellants,- applications, performance parameters- specific thrust, specific impulse, internal efficiency, propulsive efficiency- typical values. Reaction control systems- applications.

UNIT-II

AIR BREATHING ENINES FOR HYPERSONIC TRANSPORT PLANES AND MILITARY MISSILES- SUPERSONIC COMBUSTION- THE SCRAM-JET ENGINE

Performance of turbojets, ramjets at high speeds- limitations. Need for supersonic combustion- implications- criticality of efficient diffusion and acceleration, problems of combustion in high speed flow.

The scramjet engine- construction, flow process- description, control volume analysis- spill-over drag, plume drag. Component performance analysis- isolator, combustor- flow detachment and reattachment, thermal throat, scheduled, distributed fuel injection. Nozzle flow, losses- failure to recombination, viscous losses, plume losses. Scramjet performance, applications.

Combined cycle engines- turbo-ramjet, air turbo-rocket (ATR), ejector ramjet- Liquid-air collection engine (LACE)- need, principle, construction, operation, performance, applications to hypersonic transport plane and missile propulsion.

UNIT-III

CHEMICAL ROCKET ENGINES

Rocket propulsion- history, principles, types, applications. The rocket equation. Vehicle velocity, jet exit velocity, mass ratio. Effect of atmosphere. Engine parameters, propellants.

Chemical rockets- the thrust chamber- processes- combustion, expansion- propellants. Thermo-chemical analysis of combustion, equilibrium energy balance, mass balance, combustion efficiency. Equilibrium composition, recombination.

Nozzle expansion, performance, design parameters, analysis- non-equilibrium expansion- frozen equilibrium, shifting equilibrium. One dimensional, two dimensional flows, presence of liquid drops and solid particles- two phase flow, losses, efficiency.

Performance measures of chemical rocket engines- thrust coefficient, specific impulse; engine parameters- thrust chamber pressure, temperature, characteristic velocity, exhaust velocity, effective velocity. Computing rocket engine performance- theoretical, delivered performance, performance at standard operating conditions, guaranteed minimum performance.

UNIT-IV

LIQUID PROPELLANT ROCKET ENGINES

Liquid propellant rocket engines- structure- principal components, basic parameters- propellant combination, chamber pressure, nozzle area ratio, feed system, thrust level. Propellants – properties- considerations for selection- storage, feed, control, injection, ignition.

Combustion chamber and nozzle, shape, size, materials, cooling- thrust vector control, combustion instabilities. Engine control, optimisation, system integration. Liquid propellant rocket performance data.

UNIT-V

SOLID PROPELLANT ROCKET MOTORS

Basic configuration, essential differences from liquid propellant rocket engines, propellant composition, combustion chambers, ignition, surface recession rate, gas generation rate, effect of propellant temperature, combustion pressure, charge design- thrust profile, burning stability, erosive

burning. Combustion chamber integrity- thermal protection. Combustion instabilities- types, corrective measures.

Solid propellant motor components and motor design. Applications, performance analysis. Examples of solid propellant boosters. Hybrid propellant rockets, selection of rocket propulsion systems.

Advanced thermal rockets- fundamental physical limitations to thermal rockets, improving efficiency of thermal rockets in the atmosphere, pulse detonation engine, rotary rocket engine, variable exhaust velocity, optimising the ascent, descent. SSTO (single stage to orbit)- concept, practical approaches.

Particulars of propulsion systems of seleted space vehicles and military missiles.

UNIT-VI

ELECTRIC THRUSTERS- MISSION APPLICATIONS TO SPACE FLIGHT

Limitations of chemical rocket engines. Electric propulsion systems- structure, types, generation of thrust. System parameters- interrelations.

Electrothermal thrustors- resistojet, arcjet, solar/ laser/ microwave thermal propulsion- operating principles, components, system parameters, performance, applications.

Electrostatic thrusters- ionisation potenial, ionisation schemes. Beam current, power, acceleration, voltage, power efficiency, thrust-to-power ratio, specific impulse. Screen, accelerator grids, potential, charge distribution, saturated current density, electric field intensity, exhaust neutralisation, propellant choice. Estimation of performance, electrical efficiency, power to thrust ratio, thrust per unit area, applications.

Electromagnetic thrusters- magneto plasma dynamic (MPD), pulsed plasma (PPT), Hall effect and variable I_{SP} thrusters- principle, construction, operation, performance, applications.

Electric space power supplies and power conditioning- batteries, fuel cells, solar cell arrays, solar generators, nuclear power generators.

Current technology of electric propulsion engines, applications- overview. The problem of gravity loss. Criteria for selection of engine. Particulars of select current electric propulsion systems.

UNIT- VII

NUCLEAR PROPULSION

Power, thrust, energy. Nuclear fission- basics, sustainable chain reaction, calculating criticality, reactor dimensions, neutron leakage, control, reflection, prompt and delayed neutrons, thermal stability.

Nuclear propulsion- history, principles, fuel elements, exhaust velocity, operating temperature. The nuclear thermal rocket engine- radiation and management, propellant flow and cooling, control, start-up and shut-down, nozzle, thrust generation.

Potential applications of nuclear engines- operational issues, interplanetary transfer manoeuvres, faster interplanetary journey. Development status of nuclear engines, alternative reactor types, safety issues, nuclear propelled missions.

UNIT- VIII

ADVANCED PROPULSION SYSTEMS- CONCEPTS- PRINCIPLES OF OPERATION- OVERVIEW

Advanced nuclear propulsion systems- Fission fragment propulsion, radioisotope nuclear rocket, fusion propulsion, inertial, electrostatic and magnetic confinement fusion, anti-matter propulsion system.

Micropropulsion- application of MEMS- chemical, electric microthrusters- principle, description.

Propellantless propulsion- tethers- momentum exchange and electrodynamic. Photon rocket, beamed energy propulsion, solar, magnetic sails.

Breakthrough propulsion- current fundamental limits to propulsion, Casimir effect, coupling of gravity and electromagnetism, superconductor gravitational shielding, coupling of charge, mass and acceleration.

TEXT BOOKS

1. Sutton, G.P. and Biblarz, O., *Rocket Propulsion Elements*, 7th edn., Wiley, 2001, ISBN: 0-471-32642-9.
2. Hill, P.G. and Peterson, C.R., *Mechanics and Thermodynamics of Propulsion*, 2nd edn. , Addison Wesley, 1992.
3. Kerrebrock, J.L., *Aircraft Engines and Gas Turbines*, 2nd edn. , MIT Press, 1992, ISBN: 0-262-11162-4.

4. Turner, M.J.L., *Rocket and Spacecraft Propulsion, 2nd edn.,* Springer, 2005, ISBN: 3 540 22190.
5. Tajmar, M., *Advanced Space Propulsion Systems,* Springer, 2003, ISBN: 3-211-83862-7.

REFERENCES

1. Jensen, G.E. and Netzer, D.W., ed. *Tactical Missile Propulsion*, AIAA, 1996, ISBN 1-56347-118-3.
2. NASA JPL Advanced Propulsion Concepts Notebook Online, http://sec353.jpl.nasa.gov/apc/
3. *Encyclpedia Astronautica,* http://www.astronautix.com/

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III Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(56073) AIRCRAFT SYSTEMS

UNIT-I

AIRCRAFT SYSTEMS

System concepts, everyday examples of systems, sub-systems. Generic system definition, inputs, outputs, feedback, external influence. Aircraft systems- airframe systems, vehicle systems, avionics systems, mission systems and their sub-systems. Specification of requirements- mission requirements, performance requirements. Operating environment conditions.

UNIT-II

ELECTRICAL SYSTEMS

Electrical loads in aircraft. Electrical power generation and control- DC, AC-types. Power distribution- primary, secondary. Power conversion and energy storage. Load protection. Advanced systems- electrical load management systems, variable speed constant frequency (VSCS) cycloconverter, 270 V DC systems, more electric aircraft and more electric engines- implementation.

UNIT-III

HYDRAULIC SYSTEMS

Aircraft hydraulic systems- function, merits, application, system loads, design requirements. Principal components. Flight control actuation- importance, need for redundancy- types- description, applications. Advanced actuation implementations. The 'fly-by-wire' actuation, fly-by-wire control laws. Hydraulic fluid- required properties, operating fluid pressures, temperatures, and flow rates. Hydraulic piping, pumps, reservoir, accumulator. Landing gear and brake management systems.

UNIT-IV

PNEUMATIC AND ENVIRONMENTAL CONTROL SYSTEMS

Engine as source of high pressure air- engine bleed air- user systems- environment control, windscreen, wing and engine anti-ice, engine start, hydraulic, pitot-static systems. Bleed air control- structure, components,

operation. Need for controlled cabin environment. Principal heat sources in aircraft. Methods of cooling- ram air, engine bleed air, fuel cooling. Cooling systems- air cycle refrigeration- types- turbo fan, bootstrap, reverse bootstrap systems. Vapour cycle refrigeration. Humidity control. Air distribution systems, cabin pressurization, molecular-sieve oxygen concentrators, g tolerance and protection.

UNIT-V

ENGINE CONTROL AND FUEL SYSTEMS

Principle of operation of aircraft gas turbine engines. Engine- airframe interfaces. Control of fuel flow, air flow, exhaust gas flow- need, means, system parameters, basic inputs and outputs. Limited authority control systems, full authority control systems- examples. Engine monitoring-sensors, indicators. Power offtakes- need, types, effect on engine performance. Fuel systems- characteristics, components, operating modes. Fuel tank safety- fuel inerting system.

UNIT-VI

FLIGHT CONTROL SYSTEMS

Flight management, guidance, control- objectives, interrelationship. Flight control systems- primary and secondary flight control- control linkages, actuation- types, description, redundancy. Provision of trim and artificial feel. All electric aircraft. Fly-by-wire control- control laws, implementation. Advanced systems- integrated flight and propulsion control- implementation.

UNIT-VII

AIRCRAFT SYSTEMS DESIGN AND DEVELOPMENT

Safety and economic considerations- system function, performance, integrity, reliability, maintainability, product support- failure severity. Verification of meeting system requirements- means of gathering evidence in the life cycle- modeling, simulation, testing, prototype construction.

UNIT-VIII

SYSTEMS INTEGRATION

Interdependence of aircraft systems and need for integration- examples. Systems integration- the concept- examples. Levels of integration- component,

system, process, function, information levels- examples. Enumeration of aircraft systems and some subsystems- purpose, brief description, aspects of safety/ integrity, integration, interfaces, design drivers.

TEXT BOOKS

1. Moir, I. and Seabridge, A., *Design and Development of Aircraft Systems- an Introduction*, AIAA Education Series, AIAA, 2004.
2. Moir, I. and Seabridge, A., *Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration*, 3rd edn, John Wiley, 2008, ISBN 978-0-470-05996-8.

REFERENCES

1. Pallett, E.H.J., *Aircraft Instruments and Integrated Systems*, 10th edn., Longman Scientific &Technical, 1992.
2. Harris, D., *Flight Instruments and Automatic Flight Control Systems*, 6th edition, Ground Studies for Pilots, Blackwell Science, 2004, ISBN 0-632-05951-6.
3. Bolton, W., *Pneumatic and Hydraulic Systems*, Butterworth-Heinemann.
4. *Jet Engine*, Rolls Royce.

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III Year B.Tech. AE. II Semester	**Σ**	**T/P/D**	**C**
	4	**1/-/-**	**4**

(56074) FINITE ELEMENT METHODS

UNIT-I:

Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods. Basic equations of elasticity, Stress – Strain and strain - displacement relations. Rayleigh- Ritz method, Weighted residual methods.

UNIT-II:

One Dimensional problems : Stiffness equations for a axial bar element in local co-ordinates using Potential Energy approach and Virtual energy principle - Finite element analysis of uniform, stepped and tapered bars subjected to mechanical and thermal loads - Assembly of Global stiffness matrix and load vector - Quadratic shape functions - properties of stiffness matrix.

UNIT-III:

Stiffness equations for a truss bar element oriented in 2D plane - Finite Element Analysis of Trusses – Plane Truss and Space Truss elements – methods of assembly.

UNIT-IV:

Analysis of beams: Hermite shape functions – Element stiffness matrix – Load vector – Problems.

UNIT-V:

2-D problems: CST - Stiffness matrix and load vector - Isoparametric element representation – Shape functions – convergence requirements – Problems.

Unit – VI:

Two dimensional four noded isoparametric elements - Numerical integration - Finite element modelling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements - 3-D problems – Tetrahedran element.

UNIT-VII:

Scalar field problems: 1-D Heat conduction – 1D fin elements – 2D heat

conduction - analysis of thin plates – Composite slabs - problems.

UNIT-VIII:

Dynamic Analysis: Dynamic equations – Lumped and consistent mass matrices – Eigen Values and Eigen Vectors – mode shapes – modal analysis for bars and beams.

TEXT BOOKS:

1. The finite element methods in Engineering – S.S. Rao – Elsevier – 4th edition
2. Introduction to finite elements in engineering – Tirupathi K. Chandrupatla and Ashok D. Belagundu.

REFERENCES:

1. Finite Element Methods/ Alavala/TMH
2. The Finite element method in engineering science – O.C. Zienkowitz, Mc Grawhill.
3. Concepts and applications of finite element analysis – Robert Cook – Wiley
4. Introduction of Finite Element Analysis – S.Md.Jalaludeen – Anuradha publications

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III Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(56014) NANO TECHNOLOGY

(OPEN ELECTIVE)

Unit-I:

Introduction to nanotechnology:

Importance of nanoscale, Nanostructure types, electronic, magnetic, optical Properties of Nanomaterials, top-down and bottom- up approach to nanostructures.

Unit-II:

Quantum Mechanical phenomenon in nanostructures:

Quantum confinement of electrons in semiconductor Nano structures, one dimensional confinement (Quantum wires), two dimensional confinements (Quantum Wells), three dimensional confinements (Quantum dots).

Unit-III

Carbon Nano Structures:

Carbon nanotubes (CNTs), Fullerenes, C60, C80 and C240 Nanostructures, Properties (mechanical, optical and electrical) and applications.

Unit-IV

Fabrication of Nanomaterials:

Physical Methods: Inert gas condensation, Arc discharge, RFplasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Molecular beam epitaxy, Chemical vapour deposition method.

Unit-V

Nano scale characterization techniques:

Scanning probe techniques (AFM, MFM, STM, SEM, TEM), XRD

Unit-VI

Nanodevices and Nanomedicine:

Lab on chip for bioanalysis, Core/shell Nanoparticles in drug delivery systems

(site specific and targeted drug delivery), cancer treatment, and bone tissue treatment.

Unit-VII

Nano and molecular electronics:

Resonant-Tunneling structures, single electron tunneling, Single Electron transistors, coulomb blockade, giant magneto resistance, tunneling magneto resistance.

Unit-VIII

nanolithography and nanomanipulation:

e-beam lithography and SEM based nanolithography and nanomanipulation, Ion beam lithography, oxidation and metallization. Mask and its application. Deep UV lithography, X-ray based lithography.

TEXT BOOKS:

1. Charles.p.pode, Introduction to nanotechnology, springer publications
2. Springer Handbook of Nanotechnology - Bharat Bhusan
3. Phani kumar, principles of nanotechnology, scitech publications

REFERENCES BOOKS:

1. David Ferry "Transport in Nano structures" Cambridge University press 2000
2. Nanobiotechnology; ed. C.M.Niemeyer, C.A. Mirkin.
3. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S.,S. R. Kumar, J. H. Carola.
4. Encyclopedia of Nanotechnology- Hari Singh Nalwa
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. S. Dutta "Electron Transport in Mesoscopic systems" Cambridge University press
7. H. Grabert and M. Devoret "Single charge Tunneling" Plenum press 1992.

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L	T/P/D	C
3	1/-/-	3

(56066) PROBABILITY AND STATISTICS

(OPEN ELECTIVE)

UNIT-I : Probability

Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye's theorem, Random variables – Discrete and continuous.

UNIT-II: Distributions

Binomial , Poisson & normal distributions related properties . Sampling distributions –Sampling distribution of means (σ known and Unknown)

UNIT-III: Testing of Hypothesis I

Tests of hypothesis point estimations – interval estimations Bayesian estimation. Large samples, Null hypothesis – Alternate hypothesis type I, & type II errors – critical region confidential interval for mean testing of single variance. Difference between the mean.

UNIT-IV : Testing of Hypothesis II

Confidential interval for the proportions. Tests of hypothesis for the proportions single and difference between the proportions.

UNIT-V: Small samples

Confidence interval for the t- distribution – Tests of hypothesis – t-distributions, F- distributions χ^2 distribution. Test of Hypothesis –

UNIT-VI

Correlation & Regression

Coefficient of correlation – Regression Coefficient – The lines of regression – The rank correlation

UNIT-VII

Queuing Theory

Arrival Theorem - Pure Birth process and Death Process M/M/1 Model .

UNIT-VIII

Stochastic processes

Introduction to Stochastic Processes – Markov process classification of states – Examples of Markov Chains, Stochastic Matrix, limiting probabilities.

TEXT BOOKS:

1. Probability & Statistics by D.K. Murugesan & P.Guru Swamy, Anuradha Publications.
2. Probability & Statistics for Engineers by G.S.S.Bhisma Rao, Scitech Publications.

REFERENCES:

1. Probability & Statistics by T.K.V.Iyengar & B.Krishna Gandhi & Others, S.Chand.
2. Probability & Statistics by William Mendenhall & Others, Cengage Publications.
3. Higher Engineering Mathematics by B.S. Grewal, Khanna Publications.
4. Higher Engineering Mathematics by Jain & S.K.R. Iyengar, Narasa Publications.
5. A first course in Probability & Statistics by B.L.S. Prakasa Rao, World Scientific.
6. Probability & Statistics for Engineers, Miller and John E. Freund, Prentice Hall of India.

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III Year B.Tech. AE. II Semester

L	T/P/D	C
3	1/-/-	3

(56021) ENGINEERING OPTIMIZATION
(OPEN ELECTIVE)

UNIT – I

Introduction: Optimal Problem formulation: Design variables-Constraints-Objective function-Variable bounds. Engineering Optimization problems: Classification& Some examples (just theory & discussion) : Truss structure, Ammonia structure, Transit schedule and Car suspension

UNIT – II

Single variable non-linear optimization problems: Local minimum Global minimum & Inflection point. Necessary & Sufficient conditions theorems, some problems based on this. Numerical methods: Exhaustive Search methods- Fibonacci method, Golden section method & comparison. Interpolation methods: Quadratic.

UNIT – III

Multivariable unconstrained non-linear optimization problems: Numerical methods part a: Direct Search methods: Univariate method, Pattern Search methods: Powell, Hook-Jeeve's, Rosen Brock's search and Simplex methods.

UNIT – IV

Multivariable unconstrained non-linear optimization problems: Numerical methods part b: Gradient methods: Gradient of a function-Importance-Gradient direction search based methods: Steepest descent/ascent method, Conjugate gradient method and variable meteric method.

UNIT – V

Multivariable constrained non-linear optimization problems Classical optimization techniques: Constraints –equations-Lagrangian method-inequalities-Kuhn-Tucker necessary and sufficient conditions-Quadratic problem-Statement- Wolfe's and Beale's methods.

UNIT – VI

a) Geometric Programming: Posynomials – arithmetic – geometric inequality – unconstrained G.P- constrained G.P(? type only)

b) Integer Programming- Introduction – formulation – Gomory cutting plane algorithm – branch and bound method

UNIT – VII

Sensitivity Analysis: Linear programming – Formulation – Simplex method and Artificial variable techniques-Big-M & two-phase methods- Change in the cost coefficients, coefficients & constants of the constraints, addition of variables.

UNIT – VIII

a) Simulation-Definition-Steps involved- Types of simulation Models-Advantages and disadvantages- Simple problems on queuing & inventory.

b) Non-traditional optimization algorithms: Genetic algorithms: working principles differences and similarities between Gas and traditional methods. Simulated annealing.

TEXT BOOKS

1. Engineering Optimization: Theory & Practice-S.S.Rao-New Age International Publications- Thir Edition-2003

2 Optimization for Engineering Design- Kalyanmoy Deb-Prentice-Hall of India Pvt.Ltd, NewDelhi-2005.

3. Operations Research- S.D.Sharma- Kedar Nath & Ran Nath Co., New Delhi

REFERENCE TEXT BOOKS

1 Optimization Theory & Practice: Beveridge & Schechter.McGraw-Hill International Student edition.

2 Optimization in Operations Research Ronald L.Rardin. Pearson Education, Low Price Edition.

3 Optimization Theory & Practice: Mohan C.Joshi & KM Moudgalya. Narosa Publishing House, Chennai

4 Operations Research: A.P.Verma. S.K.Kataria & Sons, New Delhi-110006

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
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(56634) ADVANCED ENGLISH COMMUNICATION SKILLS LAB

1. Introduction

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

1 Gather ideas and information, to organise ideas relevantly and coherently.

1 Engage in debates.

1 Participate in group discussions.

1 Face interviews.

1 Write project/research reports/technical reports.

1 Make oral presentations.

1 Write formal letters.

1 Transfer information from non-verbal to verbal texts and vice versa.

1 To take part in social and professional communication.

2. Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

1 To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.

1 Further, they would be required to communicate their ideas relevantly and coherently in writing.

3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

- **Functional English** - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- **Vocabulary Building** – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.
- **Reading Comprehension** – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, Critical reading.
- **Writing Skills** – structure and presentation of different types of writing – *Resume writing /*

e-correspondence/Technical report writing/Portfolio writing – planning for writing – *research abilities/data collection/organizing data/tools/ analysis* – improving one's writing.

- **Group Discussion** – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- **Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars and written presentations through posters/ projects/reports/PPTs/e-mails/assignments etc.
- **Interview Skills** – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.

4. Minimum Requirement:

The English Language Lab shall have two parts:

i) **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
a) Speed – 2.8 GHZ
b) RAM – 512 MB Minimum
c) Hard Disk – 80 GB
ii) Headphones of High quality

5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

Suggested Software:

- **Clarity Pronunciation Power** – part II
- **Oxford Advanced Learner's Compass**, 7th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed,**
  - **Positive Thinking,**
  - **Interviewing Skills,**
  - **Telephone Skills,**
  - **Time Management**
  - **Team Building,**
  - **Decision making**
- **English in Mind**, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

6. Books Recommended:

1. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.

2. **Advanced Communication Skills Laboratory Manual** by Sudha Rani, D, Pearson Education 2011.

3. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.

4. **English Vocabulary in Use** series, Cambridge University Press 2008.

5. **Management Shapers Series** by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.

6. **Communication Skills** by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.

7. **Handbook for Technical Writing** by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.

8. **Job Hunting** by Colm Downes, Cambridge University Press 2008.

9. **Master Public Speaking** by Anne Nicholls, JAICO Publishing House, 2006.

10. **English for Technical Communication for Engineering Students**, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.

11. Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron's/DELTA/ Cambridge University Press.

12. **International English for Call Centres** by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

Advanced Communication Skills Lab Practicals:

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.

2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

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(56635) FLIGHT VEHICLE DESIGN LAB

1. Specification of design requirements- mission profile- conceptual sketches, initial sizing.

2. Airfoil and geometry selection, determination of thrust to weight ratio, wing loading.

3. First sizing & configuration layout, crew station, passengers & payload.

4. Propulsion & fuel system integration, landing gear & subsystems.

5. Baseline Design Analysis- Aerodynamics & Propulsion, Structures & Weight And Balance.

6. Baseline design– stability & control, performance and constraint analysis.

7. Cost estimation, parametric analysis, optimisation, refined sizing &trade studies.

8. Determination of final baseline design configuration, preparation of type specification report.

REFERENCES

1. Jenkinson, L.R. and Marchman III, J. F., *Aircraft Design Projects for Engineering Students*, Butterworth Heinemann, 2003, ISBN: 0 7506 5772 3.

2. Raymer, D.P., *Aircraft Design: A Conceptual Approach*, 3rd edn., AIAA Education Series, AIAA, 1999, ISBN: 1-56347-281-0.

3. *Fielding, J.P., Introduction to Aircraft Design, Cambridge University Press, 2005, ISBN: 0-521-657222-9. AIAA Aerospace Design Engineer's Guide*, 5th edn., AIAA Education Series, 2003, ISBN 1-56347-590-1.

4. Keane, A.J. And Nair. P.B., *Computational Approaches for Aerospace Design*, Wiley, 2005, ISBN:0-470-85540-1.

5. Taylor, J., *Jane's All the World Aircraft*, latest edition, Jane's, London.

6. Stinton, The Design of the Airplane, second edition, AIAA, 2001, ISBN: 0-56347-524-6.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. I Semester

L	T/P/D	C
4	1/-/-	4

(57114) AIRFRAME STRUCTURAL DESIGN

UNIT-I

INTRODUCTION

Structural design and sizing- stages- preliminary, detail- significance- scope of the course- preliminary.

Principal structural components of aircraft. Design requirements- structural integrity, stiffness, service life. Constraints- baseline aerodynamic configuration, external loading, weight, operating conditions, conformity to government regulations. Other considerations- design for durability, damage tolerance, stretching, extension of life; for manufacturing, assembly, maintenance, repair.

Design procedure- structural lay out, structural modelling, design criteria, load estimation, stress analysis, choice of materials, sizing- estimation of strength, stiffness, mass. Optimisation, trade-off. Structural index- use in design.

UNIT-II

BASIC DATA FOR STRUCTURAL DESIGN- EXTERNAL LOADS- ESTIMATION- MATERIAL PROPERTIES- AIRWORTHINESS REQUIREMENTS

Airworthiness requirements - loads, safety margins, material properties, methods of estimation- construction, operation, maintenance, training- procedures. Critical load conditions. Limit and ultimate loads- definition, significance. Aircraft materials- mechanical properties- design data- allowable, allowable bases. Failure theory. Flight loads- atmospheric, maneuver- construction of flight envelope.

Wing loads- air load span wise distribution, effect of fuselage, engine nacelle, wing stores, control surfaces, landing, taxi, dynamic gust loads, wing weight distribution. Empennage loads- gust, maneuver, control surface. Fuselage loads- distribution of weight, fore body loads, after body loads, internal pressure, propulsion loads. Landing gear loads- landing conditions, ground handling loads, retraction loads. Miscellaneous loads. Airplane weight data, stiffness data.

UNIT-III

REVIEW OF MODELING OF STRUCTURAL ELEMENTS, JOINTS AND LOADING- DETERMINATION OF LOADS, STRESSES, DEFORMATIONS, ULTIMATE STRENGTH, SIZING

Idealisation of structures, materials- constitutive relations- equilibrium, compatibility conditions- significance. Estimation of axial, bending, shear and torsion loads of determinate and indeterminate structures- 2D and 3D trusses, beams, frames, shafts, plates, shells. Determination of stiffness, deflections- influence coefficients.

Stress analysis, determination of principal stresses- estimation, significance, limitations. Failure theory. Buckling strength of columns. Thin walled sections- shear and compression panels, buckling, post buckling behaviour, ultimate strength. Sizing of structural elements of given geometry and loading. Analysis of box beams- single cell, multi cell- in bending, shear, torsion- normal stresses, shear flow, deformation- restraint against warping, secondary stresses. Effect of cut-outs

UNIT-IV

FASTENERS AND STRUCTURAL JOINTS

Fasteners and fittings- role, significance, general design considerations, criteria for allowable strength. Margins of safety. Fastener systems, types, fastener information, dimensions, material, allowable strength- tensile, shear, bending, bearing, Rivets, bolts and screws, nuts- detail design considerations. Fastener selection. Fittings- lugs, bushings and bearings- loading, design and analysis. Joints- spliced, eccentric, gusset, welded, brazed, bonded- types, methods of joining, failure modes. Fatigue design considerations. Stress concentration- causes, methods of reduction. Fastener load distribution and by-pass load- severity factor, structural joint life prediction. Shim control and requirement.

UNIT-V

DESIGN OF WING, TAIL UNIT STRUCTURES

The wing- role- summary of wing loads, structural components- wing box, leading and trailing edges. Wing layout- location of spars, ailerons and flaps, rib spacing and direction, root rib bulkhead, span wise stiffeners, wing covers- skin-stringer panels, integrally stiffened panels, access holes, attachment of leading edge and trailing edge panels. Spars- general rules of spar design.

Ribs and bulkheads- rib spacing and arrangement. Wing root joints, carry through structure. Fighter wing design- problems with swept wings

Wing box, root rib bulkhead- estimation of loads, stress analysis, design parameters, optimisation, sizing, margins of safety. Leading and trailing edge assembly- control surfaces, flaps- structure, mechanical design- design considerations.

Tail unit- horizontal, vertical tail, elevator, rudder- configurations, structural lay out, design considerations.

UNIT-VI

DESIGN OF FUSELAGE

Function of fuselage- loading, general requirements. Ultimate strength of stiffened cylindrical structure- review, Principal structural components- skin and stringers, frame and floor beam, pressure bulkhead, wing and fuselage intersection- lay out, loading, stress analysis, sizing. Forward fuselage, aft fuselage structures, fuselage openings- windows, doors- design considerations.

UNIT-VII

DESIGN OF LANDING GEAR, ENGINE MOUNTS

Landing gear- purpose, types, general arrangement, loads- design considerations- ground handling, take-off, landing, braking, pavement loading, support structure. stowage and retraction, gear lock- kinematic design. Shock absorbers- function, types, components, operation, loads, materials, design. Wheels and brakes, tire selection

Engine mounts- types- wing pod, rear fuselage, tail, fuselage mount, loads, design considerations.

UNIT-VIII

FATIGUE LIFE, DAMAGE TOLERANCE, FAIL-SAFE DESIGN- WEIGHT CONTROL AND BALANCE

Catastrophic effects of fatigue failure- examples- modes of failure- design criteria- fatigue stress, fatigue performance, fatigue life. Fatigue design philosophy- fail-safe, safe life. Service behaviour of aircraft structures- effect of physical and load environment design and of detail of fabrication Structural life- methods of estimation- the scatter factor- significance Fail-safe design- the concept, requirements, damage tolerance- estimation of fatigue strength

TEXT BOOKS

1. Niu, M.C., Airframe Structural Design, second edition, Hongkong Conmlit Press, 1988, ISBN: 962-7128-09-0.
2. Niu, M.C., Airframe Stress Analysis and Sizing, second edition, Hongkong Conmlit Press, 1997, ISBN: 962-7128-08-2.
3. Bruhn, E.H., Analysis and Design of Flight Vehicles Structures, Tri - state Offset Company, USA, 1965.

REFERENCES

1. Peery, D.J, and Azar, J.J., Aircraft Structures, second edition, Mc Graw-Hill, N.Y., 1993.
2. Megson, T.H.G., Aircraft Structures for Engineering Students, Butterworth-Heinemann/ Elsevier, 2007.
3. Raymer, D.P., *Aircraft Design: A Conceptual Approach*, 3rd edn., AIAA Education Series, AIAA, 1999, ISBN: 1-56347- 281-0.
4. Fielding, J.P., Introduction to Aircraft Design, Cambridge University Press, 2005, ISBN: 0-521-657222-9.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. I Semester	**L**	**T/P/D**	**C**
	4	**1/-/-**	**4**

(57115) MECHANICAL VIBRATIONS AND STRUCTURAL DYNAMICS

UNIT I

INTRODUCTION- SINGLE DEGREE OF FREEDOM SYSTEMS

Simple harmonic motion, terminology. Degrees of freedom. Free vibrations and forced vibrations- examples of single degree of freedom mechanical vibrations, equation of motion. Spring, inertia, damping elements. Undamped natural frequency, damped natural frequency, damping ratio. Mechanisms of damping. Equivalent viscous damping. Forced vibrations. Examples. Resonance. Vibration measuring instruments. Amplitude and Phase response diagrams.

D'Alembert's principle- inertial force.

UNIT II

VIBRATION OF DISCRETE SYSTEMS

Two / Three degree of freedom systems. Static and dynamic coupling. Examples. Principal coordinates, principal modes- orthogonality conditions. Extension to multiple degrees of freedom systems. Vibration absorbers.

UNIT III

VIBRATION OF CONTINUOUS SYSTEMS

Introduction to Hamilton's Principle. Longintudinal, transverse and torsional vibration of cylindrical shafts- extension to tapered shafts. Dynamical equations of equilibria of general elastic bodies.

UNIT IV

DETERMINATION OF NATURAL FREQUENCIES AND MODE SHAPES

Natural vibrations of solid continua. Methods of determining natural frequencies and mode shapes.

UNIT V

ROTATING SHAFTS

Natural frequency of rotating shafts. Whirling of shafts. Dynamic balancing of rotating machinery. Dynamic dampers.

UNIT VII

MATRIX METHODS

Matrices for dynamic analysis. Kinematically consistent load systems and determination of [K], [M], [C] and [L] matrices.

Normalization and formulation of modal equations.

UNIT VI

APPROXIMATE METHODS OF VIBRATION ANALYSIS

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

UNIT VIII

INTRODUCTION TO AEROELASTIC STABILITY

Aeroelastic and inertial coupling. Collar's triangle. Static and dynamic aero elastic phenomena. Aeroelatic instabilities and their prevention. Wing divergence, control reversal and wing flutter, flutter speed. Aero elastic tailoring.

TEXT BOOKS

1. R.W. Clough and Penzien, *Dynamics of Structures.*
2. Rao, Singiresu S. *Mechanical Vibrations*, Pearson Education LPE-2004.
3. Rao, J.S and Gupta .K., *Theory and practice of Mechanical Vibrations*, Wiley Eastern Ltd., New Delhi, 2002.

REFERENCES

1. Megson, T.H.G., *Aircraft Structures for Engineering Students* Butterworth-Heinemann is an imprint of Elsevierl, Oxford OX2 8DP, UK- 2007
2. Fung, Y.C., *An Introduction to Theory of Aeroelasticity*, John Wiley & Sons, NewYork,1984
3. Timoshenko, S., *Vibration Problems in Engineering.* John Wiley and Sons, New York,1987.
4. Harris & Creed, *Shock and Vibrations,* third edition, McGraw-Hill Book Company.

5. Singh, V.P., *Mechanical Vibrations,* Dhanapati Rai and Co. 2003 edition.

6. Grahamkelly, S., *Mechanical Vibrations,* TMH 2004 edition.

7. Groover, G.K., *Mechanical Vibrations*, Nemchand and Brothers 2001 edition.

8. *Vibrations and Waves MIT series 1987,* CBS Publishers and Distributors

9. Scanlon, R.H., & Rosenbaum, R., *Introduction to the Study of Aircraft Vibration & Flutter* John Wiley and Sons, New York, 1982

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IV Year B.Tech. AE. I Semester	**L**	**T/P/D**	**C**
	4	**1/-/-**	**4**

(57024) CAD / CAM

UNIT – I

INTRODUCTION

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

UNIT – II

COMPUTER GRAPHICS

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

UNIT – III

GEOMETRIC MODELLING

Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modelling facilities desired.

UNIT – IV

DRAFTING AND MODELLING SYSTEMS

Basic geometric commands, layers, display control commands, editing, dimensioning, and solid modelling.

UNIT – V

NUMERICAL CONTROL

NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining centre, turning centre, CNC Part Programming-fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT – VI

GROUP TECH

Part family, coding and classification, production flow analysis, advantages

and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

UNIT – VII

COMPUTER AIDED QUALITY CONTROL

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

UNIT – VIII

COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labour in the manufacturing systems, CIMS benefits.

TEXT BOOKS

1 Zimmers, A. & Groover, P., *CAD/ CAM,* Prentice- Hall India

2 Zeid, Ibrahim, *CAD / CAM Theory and Practice*, Tata McGraw-Hill.

REFERENCES

1. Groover, P., *Automation , Production Systems & Computer Integrated Manufacturing*, Pearson Education.

2. Groover, P., *Automation , Production Systems & Computer Integrated Manufacturing*, Pearson Education

3. Lalit Narayan ,et al., *Computer Aided Design and Manufacturing*, Prentice-Hall India.

4. Radhakrishnan and Subramanian, *CAD / CAM / CIM*, New Age.

5. Amirouche, F., *Principles of Computer Aided Design and Manufacturing*, Pearson.

6. Alavala, *CAD/ CAM: Concepts and Applications*, PHI

7. Seames, W.S., *Computer Numerical Control Concepts and Programming, Thomson.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. I Semester

L	T/P/D	C
5	1/-/3	3

(57116) CONTROL THEORY- APPLICATION TO FLIGHT CONTROL SYSTEMS

UNIT-I

CONTROL SYSTEMS- MODELING, PERFORMANCE– TIME, FRQUENCY AND S-DOMAIN DESCRIPTION.

Dynamical systems- principal constituents- input, output- process (plant)- block diagram representation. Inputs- control input, noise. Function of control as regulation (hold), tracking (command)- examples. Measure of effectiveness. Sensitivity of output to control input, noise and system parameters- robustness. Deterministic and stochastic control. Control in every day life. The pervasiveness of control in nature, engineering and societal systems. The importance of study of control system. Need for stable, effective (responsive), robust control system.

Modeling of dynamical systems by differential equations- system parameters. Examples from diverse fields. First and second order systems, higher order systems, single input single output systems, multiple-input-multiple-output systems- linear and nonlinear systems. Need for approximations. Review of linearisation of nonlinear systems- assumptions, validity. Time invariant linear systems.

Control system performance- time domain description- output response to control inputs— impulse and indicial response- characteristic parameters- significance- relation to system parameters- examples- first and second order linear systems, higher order systems. Synthesis of response to arbtrary input functions from impulse and indicial response.

Review of Fourier transforms and Laplace transforms- inverse transforms- significance, applications to differential equations. 's' (Laplace) domain description of input-output relations- transfer function representation- system parameters- gain, poles and zeroes. Characteristic equation- significance- examples. frequency and damping ratio of dominant poles. Relation of transfer function to impulse respone. Partial fraction decomposition of transfer functions- significance.

Frequency domain description- frequency response- gain and phase shift-

significance- representation- asymptotic (Bode) plots, polar (Nyquist) plots, frequency transfer functions. Characteristic parameters- corner frequencies, resonant frequencies, peak gain, bandwidth- significance. First and second order systems- extension to higher order systems.

UNIT-II

FEEDBACK CONTROL

The concept of feedback- feedback as inherent element in nature- physical, biological, societal systems, by design in engineering systems- open loop control, closed loop control. Effect of feedback on input output relation, stability, robustness. Merits of feedback control. Loop gain, feedback gain-significance. System type, steady state error, error constants- overall system stability. Application of feed back in stability augmentation, control augmentation, automatic control- examples.

Composition, reduction of block diagrams of complex systems- rules and conventions. Control system components- sensors, transducers, servomotors; actuators, filters- modeling, transfer functions. Single-input-single-output systems. Multiple input- multiple output systems, matrix transfer functions- examples.

Types of control problems- the problem of analysis, control synthesis, system synthesis- examples- static control of aircraft. Extension to dynamic control. System identification from input output measurements- importance. Experimental determination of system transfer functions by frequency response measurements. Example.

UNIT-III

SPECIFICATION OF CONTROL SYSTEM PERFORMANCE REQUIREMENTS- SYSTEM SYNTHESIS- CONTROLLERS-COMPENSATION TECHNIQUES

Control system performance requirements- transient and steady state-specification- desired input-output relation- speed of response, stability, accuracy, steady state error, robustness. Relation with system parameters. Examples of first and second order systems. Specifications in frequency domain, 's' domain. Conflicting requirements- need for compromise- scope for optimisation. The primacy of stability.

System synthesis- need for compensation- design of controllers- active, passive- series, feed forward, feedback controllers. Proportional, integral, proportional plus derivative control- the problem with derivative control -

lead, lag, lead-lag, wash-out, notch filters/ networks- properties- effect on transfer function, stability, robustness- relative merits. Adaptive control-definition, merits, implementation- gain scheduling. Non linear control, merits, constraints.

Feedback controllers. Significance of loop transfer function, loop gain. Stability of closed loop system- frequency response methods and root locus methods of analysis and compensation- Nyquist's criterion- stability margins-phase margin, gain margin- interpretation, significance- compensation by pole zero cancellation. Design of multi loop feedback systems.

UNIT-IV

AIRCRAFT RESPONSE TO CONTROLS- FLYING QUALITIES-STABILITY AND CONTROL AUGMENTATION- FLY BY WIRE CONTROL

Approximations to aircraft transfer functions, control surface actuators-review. Response of aircraft to pilot's control inputs, to atmosphere. The control task of the pilot. Flying qualities of aircraft- relation to airframe transfer function. Reversible and irreversble flight control systems. Pilot's opinion ratings. Flying quality requirements- pole-zero, frequency response and time-response specifications. Stability augmentation systems- displacement and rate feedback- determination of gains- conflict with piilot inputs- resolution-control augmentation systems- Full authority fly-by-wire. Need for automatic control.

UNIT-V

APPLICATION OF CLASSICAL CONTROL THEORY TO ANALYSIS AND DESIGN OF AUTOPILOTS

Autopilots- purpose, functioning- inputs- hold, command, track. Displacement autopilots- pitch, yaw, bank, altitude and velocity hold- purpose, relevant simplified aircraft transfer functions, feedback signals, control actuators- operation, analysis, performance. Manoeuvering autopilots- normal acceleration, turn rate, pitch rate commands- applications.

Autopilot design by displacement and rate feedback- iterative methods, design by displacement feedback and series PID compensator - Zeigler and Nichols method. Autopilots viewed as stability augmentors. Robust control. Typical aircraft autopilots of civil and military aircraft- description of design, construction, operation, performance.

UNIT- VI

MODERN CONTROL THEORY- STATE SPACE MODELING, ANALYSIS

Limitations of classical methods of control system modeling, analysis and design, applied to complex, multiple input multiple output systems. State space modeling of dynamical systems- state variables-definition- state equations. The output variable- the ouput equation- representation by vector matrix first order differential equations. General form, time invariant linear systems. Matrix transfer function. State transition matrix- matrix exponential- properties- numerical solution of state equations- illustrative examples.

UNIT- VII

STATE FEED BACK DESIGN OF TIME INVARIANT LINEAR CONTROL SYSTEMS

Canonical transformation of state equations- significance- eigenvalues- real distinct, repeated, complex. Controllability and observability- definition- significance. Placement of eigen values by state feedback design- numerical method for determining feedback gains for mutiple input multiple output systems. Need for state variable reconstruction- the state observer. Illustrative examples.

UNIT- VIII

OPTIMAL CONTROL SYSTEM DESIGN- LINEAR QUADRATIC PROBLEMS- APPLICATION TO STABILITY AUGMENTATION AND AIRCRAFT AUTOPILOTS

Statement of the problem- the objective function- inclusion of cost constraints- linear quadratic problems- determinaion of feedback gain matrix- reduction to Matrix Riccati equation. Outline of the solution. Illustrative examples. Application to stability augmentation- extension to autopilot design.

Digital control systems- overview- advantages, disadvantages.

TEXT BOOKS

1 Kuo, B.C., *Automatic Control Systems,* Prentice Hall India, 1992, ISBN 0-87692-133-0.

2 Stevens, B.L. and Lewis, F.L., Aircraft Control and Simulation, John Wiley, 1992, ISBN0-471-61397-5.

3 Nelson, R.C., *Flight Stability and Automatic Control,* second edition, Tata McGraw-Hill, 2007, ISBN: 0-07-066110-3.

4 Yechout, T.R. et al., Introduction to Aircraft Flight Mechanics, AIAA, 2003, ISBN 1-56347-577-4.

REFERENCES

1. Mc Lean, D., *Automatic Flight Control Systems,* Prentice Hall, 1990, ISBN: 0-13-154008-0.

2. Bryson, A.E., *Control of Aircraft and Spacecraft,* Princeton University Press, 1994, ISBN: 0-691-08782-2.

3. Collinson, R.P.G., *Introduction to Avionics Systems,* second edition, Springer, 2003, ISBN: 978-81-8489-795-1.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. I Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(57117) ADVANCED COMPUTATIONAL AERODYNAMICS (ELECTIVE-I)

UNIT-I

PANEL METHODS

Basic formulation, boundary conditions, physical considerations, reduction of a problem to a set of linear algebraic equations, aerodynamic loads, preliminary considerations prior to establishing numerical solution, steps toward constructing a numerical solution, Solution of thin airfoil with lumped vortex filament, accounting for effects of compressibility and viscosity. Two-dimensional constant-strength singularity elements-sources, doublets and vortices, Two-dimensional constant strength singularity solutions using Neumann and Dirichlet boundary conditions-constant source, doublet and vortex methods

UNIT-II

METHOD OF CHARACTERISTICS

Philosophy of method of characteristics, determination of characteristic lines-two-dimensional irrotational flow, determination of compatibility equations, unit processes, supersonic nozzle design by the method of characteristics-supersonic wind tunnel nozzle, minimum length nozzles, Domain of dependence and range of influence

UNIT-III

NUMERICAL SOLUTION OF TRANSONIC SMALL DISTURBANCE EQUATION

Physical aspects of transonic flows-critical Mach number, drag divergence Mach number, area rule, supercritical airfoils, theoretical aspects of transonic flows-transonic similarity. Derivation of Transonic Small Disturbance(TSD) equation, finite difference formulation of TSD equation, Murman- Cole switching/upwinding in supersonic flow regions, boundary conditions, iterative solution methods for discretized TSD equation

UNIT-IV

NUMERICAL METHODS FOR EULER EQUATIONS

Flux approach- Lax-Wendroff method, Basic principles of upwind schemes, Flux-vector splitting- Steger-Warming flux vector splitting, Van Leer flux vector splitting, Upwind reconstruction- evolution- Godunov's first order upwind method, Roe's first order upwind method

UNIT-V

NUMERICAL SOLUTION OF BOUNDARY LAYER EQUATIONS

Setting up the boundary layer equations- flat plate boundary layer solution, Boundary-layer transformations- explicit and implicit discretization- solution of the implicit difference equations- integration of the continuity equation. Boundary layer edge and wall shear stress, Keller-box scheme.

UNIT-VI

TIME DEPENDENT METHODS-I

Stability of solution, explicit methods, FTFS, FTCS, FTBS, Lax method-leapfrog method, Lax method- implicit methods- Euler's FTCS, Crank-Nicolson method.

UNIT-VII

TIME DEPENDENT METHODS-II

Description of Lax- Wendroff scheme, McCormack two step predictor-corrector method, Description of time split methods, Approximate factorization schemes

UNIT-VIII

BOUNDARY CONDITIONS

Concept of dummy cells, Solid wall-inviscid flow, Viscous flow, Farfield-concept of characteristic variables, modifications for lifting bodies, Inlet/output boundary, Injection boundary, symmetry plane, coordinate cut, periodic boundaries, interface between grid blocks, flow gradients at boundaries of unstructured grids

TEXT BOOKS

1. Tannehill, John C , Anderson, Dale A, , Pletcher Richard H.. *Computational Fluid Mechanics and Heat Transfer*, Second Edition, Taylor & Francis, 1997

2. Chung, T. G., *Computational Fluid Dynamics*, Second Edition, Cambridge University Press, 2010

REFERENCES

1 Katz, Joseph and Plotkin, Allen, *Low-Speed Aerodynamics,* Second Edition, Cambridge University Press, 2006.

2 Anderson, J. D., *Modern Compressible Fluid Flow,* McGraw Hill, 1982.

3 Anderson, J. D., *Fundamentals of Aerodynamics,* Fifth Edition, Tata McGraw Hill, 2010

4 Anderson, J. D., *Computational Fluid Dynamics,* McGraw Hill

5 Rathakrishnan, E., *Gasdynamics*, Prentice-Hall India, 2004

6 Laney, C. B., *Computational Gasdynamics,* Cambridge University Press, 1998

7 Schlichting, H. and Gersten, K., *Boundary-Layer Theory,* Springer, 2000

8 Blazek, J., *Computational Fluid Dynamics: Principles and Applications,* 2nd Edition, Elsevier, 2007

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. I Semester

L	T/P/D	C
3	1/-/-	3

(57118) FLIGHT SCHEDULING AND OPERATIONS (ELECTIVE- I)

UNIT-I

NETWORK FLOWS AND INTEGER PROGRAMMING MODELS

Complexity of airline planning, operations and dispatch- need for optimization- role of operations research and simulation. Networks- definitions, network flow models- shortest path problem, minimum cost flow problem, maximum flow problem, multi-commodity problem. Integer programming models- set covering/ partitioning problems, traveling salesman problem- mathematical formulation- decision variables, objective function, constraints, methods of solution. Solution by simulation.

UNIT-II

FLIGHT SCHEDULING

Significance of flight scheduling. The route system of the airlines- point-to-point flights, hub and spoke flights. Schedule construction- operational feasibility, economic viability. Route development and flight scheduling process- load factor and frequency- case study.

UNIT-III

FLEET ASSIGNMENT

Purpose of fleet assignment. Fleet types, fleet diversity, fleet availability- performance measures, Formulation of the fleet assignment problem- decision variables, objective function, constraints, solution. Scenario analysis, fleet assignment models.

UNIT-IV

AIRCRAFT ROUTING

Goal of aircraft routing- maintenance requirements, other constraints. Routing cycles, route generators. Mathematical models of routing- decision variables, objective functions, alternatives, constraints- flight coverage and aircraft available. Example problems and solutions.

UNIT-V

CREW AND MANPOWER SCHEDULING

Crew scheduling process- significance. Development of crew pairing- pairing generators- mathematical formulation of crew pairing problem- methods of solution. Crew rostering- rostering practices. The crew rostering problem- formulation, solutions. Manpower scheduling- modeling, formulation of the problem, solutions.

UNIT-VI

GATE ASSIGNMENT AND AIRCRAFT BOARDING STRATEGY

Gate assignment- significance- the problem- levels of handling-passenger flow, distance matrix- mathematical formulation, solution. Common strategies for aircraft boarding process, mathematical model, interferences, model description, aisle interferences.

UNIT-VII

AIRLINE IRREGULAR OPERATION, DISRUPTION OF SCHEDULE AND RECOVERY

The problem statement, the time band approximation model- formulation of the problem- the scenarios- solution.

UNIT-VIII

COMPUTATIONAL COMPLEXITY, CASE STUDIES OF AIRLINE OPERATIONS AND SCHEDULING AND SIMULATION

Complexity theory, heuristic procedures. Case studies of airline operation and scheduling- study through simulation modeling- use of available software.

TEXT BOOK

1 Bazargan, M.,'Airline Operations and Scheduling', 2nd edn., Ashgate Publishing Ltd, 2010.

REFERENCES

1. Belobaba, P., Odoni, A., Barnhart, C. 'The Global Airline Industry', Wiley, 2009.
2. Wu, Cheng-Lung, 'Airline Operations and Delay Management', Ashgate Publishing Ltd, 2010.

3. Wensveen, J.G., 'Air Transportation: A Management Perspective', 6th edn., Ashgate Publishing Ltd, 2007.
4. Ahuja,R. et al, 'Network Flows-Theory, Algorithms and Applications', Prentice-Hall, 1993.
5. Yu, G., "Operations Research in Airlines Industry", Academic Publishers, 1998.
6. www.airlinestechnology.net

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IV Year B.Tech. AE. I Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(57119) MECHANISMS AND MECHANICAL DESIGN (ELECTIVE – I)

UNIT – I

MECHANISMS

Elements of links – classification – rigid link, flexible and fluid link. Types of kinematic pairs – sliding, turning,

rolling, screw and spherical pairs. Lower and higher pairs, closed and open pairs. Constrained motion –

completely, partially or successfully constrained, and incompletely constrained.

UNIT- II

MACHINES

Mechanism and machines – classification. Kinematic chain, inversion of mechanism, inversion of quadratic cycle. Chain – single and double slider crank chains. Exact and approximate straight line mechanisms - Peaucellier, Hart T. Chibichef, Pantograph.

UNIT – II

KINEMATIC ANALYSIS OF MECHANISMS

Velocity and acceleration. Motion of link in machine – determination of velocity and acceleration diagrams –

graphical method. Application of relative velocity method for four bar chain. Analysis of slider crank chain for displacement, Velocity and acceleration of sliding – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

UNIT – III

PLANE MOTION OF BODY

Instantaneous centre of rotation, centroids and axodes – Relative motion between two bodies – Three centres in line

theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

GYROSCOPIC MOTION- PRECESSION

The gyroscope- free and restrained- working principle- the free gyro, rate gyro, integrating gyro as motion measuring instruments. Effect of precession on the stability of vehicles- motorbikes, automobiles, airplanes and ships. Static and dynamic forces generated due to in precession in rotating mechanisms.

UNIT – V

CAMS AND FOLLOWERS

Cams and followers- definition, uses – types– terminology. Types of follower motion- uniform velocity, simple harmonic motion and uniform acceleration. Maximum velocity and acceleration during outward and return strokes. Roller follower, circular cam with straight, concave and convex flanks.

UNIT- VI

STEERING GEARS

Condition for correct steering – Davis steering gear, Ackerman's steering gear– Velocity ratio, Hook's Joint– single and double Hooks joint– universal coupling– applications.

UNIT – VII

GEARS AND GEAR TRAINS

Introduction to gears- types, law of gearing. Tooth profiles- specifications, classification- helical, bevel and worm gears, simple and reverted gear train, epicyclic gear trains- velocity ratio or train value.

UNIT- VIII

DESIGN OF FOUR BAR MECHANISMS

Four bar mechanism, Freudenstein equation. Precession point synthesis, Chebyshev's method, structural error

TEXT BOOKS

1. Theory of Mechanisms and machines, Amithab Ghosh and Asok Kumar Malik, East West Press Pvt.LTD-2001.
2. Mechanism and Machine Theory, JS Rao and RV Dukkipati / New Age – 1996.

REFERENCES

1. Theory of Machines, Dr Jagdish Lal, JM Shaw.
2. Theory of Machines, Abdulla Sharif, Dhanpat Rai, 1987.
3. Theory of Machines, PL Ballaney, Khanna Publishers, 2003.
4. Theory of Machines Through Solved Problems, JS Rao / New Age – 1996
5. Mechanical engineering and design, J.E.Shigley and Charles.R.Mischke, TMH, 2003.

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IV Year B.Tech. AE. I Semester

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3	1/-/-	3

(57120) THEORY OF ELASTICITY (ELECTIVE–I)

UNIT-I

INTRODUCTION

Elasticity – notation for forces and stress components of stresses - components of strain - Hooks law. Plane Stress and plain strain analysis - plane stress - plane strain- differential equations of equilibrium - boundary cqnditions – compatibility equations –stress function - boundary condition.

UNIT-II

TWO-DIMENSIONAL PROBLEMS- I

Two dimensional problems in rectangular co-ordinates-solution by polynomials - Saint-venant's principle- determination of displacements-bending of simple beams-application of Fourier series methods for two dimensional problems - gravity loading.

UNIT-III

TWO-DIMENSIONAL PROBLEMS- II

Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates – displacements - displacement for symmetrical stress disiribution - simple symmetric and asymmetric problems - general solution of two-dimensional problem in polar coordinates - application of general solution in polar coordinates.

UNIT-IV

THREE-DIMENSIONAL PROBLEMS

Analysis of stress and strain in three dimensions - principal stress - stress ellipsoid - director surface - determination of principal stresses - maximum shear stresses - homogeneous deformation - principal axes of strain rotation. General theorems.

UNIT-V

GOVERNING EQUATIONS

Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of superposition - uniqueness of solutions - the reciprocal theorem.

UNIT-VI

TORSION

Torsion of prismatic bars - torsion of prismatic bars - bars with elliptical cross sections - other elementary solution - membrane analogy - torsion of rectangular bars-solution of torsional problems by energy method - use of soap films in solving torsion problem - hydro dynamical analogies - torsion of shafts, tubes, bars etc.

UNIT-VII

BENDING

Bending of prismatic Bars: Stress function - bending of cantilever - circular cross section – elliptical cross section – rectangular cross section - bending problems by soap film method - displacements

UNIT-VIII

PLASTICITY

Theory of plasticity: Introduction - concepts and assumptions - yield criteria.

TEXT BOOK

1. Timoshenko, S.P. and Goodier, J.N., *Theory of Elasticity*, Tata McGraw Hill.

REFERENCES

1. Chakrabarty, *Theory of Plasticity*, McGraw-Hill Publications.
2 *Fung, Y.C., An Introduction to the* Theory of Aeroelasticity, Dover Publications.
3 Gurucharan Singh, *Theory of Elasticity.*
4 Sadhu Singh, *Theory of Elasticity*, Khanna Publications.

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IV Year B.Tech. AE. I Semester

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3	1/-/-	3

(57121) SPACE MECHANICS
(ELECTIVE-II)

UNIT-I

BASIC CONCEPTS

The solar system, comets and meteors, Kepler's laws and Newton's law of gravitation, concept of celestial sphere, vernal equinox, ecliptic. Coordinate systems- ECI system, geographic coordinate system, azimuth-elevation coordinate system, ecliptic system, Time systems- sidereal time, mean solar time, Julian date, universal time, ephemeris time.

UNIT-II

TWO-BODY ORBITAL MECHANICS

N-body problem, two-body problem- simplifying assumptions. Equations of relative motion. Constants of the motion- conservation of angular momentum, Trajectory equation, elliptical orbit- geometry of the ellipse, period of an elliptical orbit, circular orbit, parabolic orbit, hyperbolic orbit. Geometry of the hyperbola, hyperbolic excess speed. Orbital elements.

UNIT-III

BASIC ORBITAL MANEUVRES

Low altitude earth orbits- effect of orbital altitude on satellite life times, direct ascent to orbit, perturbations of low earth orbits due to the oblate shape of the Earth. High altitude earth orbits- the synchronous satellite, launching a high altitude satellite. In-plane orbit changes- adjustment of perigee and apogee height, Hohmann transfer, general coplanar transfer between circular orbits, Out-of plane orbit changes-simple plane change.

UNIT-IV

ORBIT PERTURBATIONS

General overview of orbit perturbations, Earth gravity harmonics, lunisolar gravitational attractions, solar radiation pressure effects, atmospheric drag effects, tidal friction effects and mutual gravitational attraction. earth's

oblateness (J_2) effects, critical inclination. Sun-synchronous orbits, J_3 effects and frozen orbits, Earth's triaxiality effects and east-west station keeping.

UNIT- V

BALLISTIC MISSILE TRAJECTORIES

The general ballistic missile problem- geometry of the trajectory, free flight range equations, flight path angle equation, maximum range trajectory, time of free flight. Effect of launching errors on range- effect of lateral displacement of the burnout point, cross range error due to incorrect launch azimuth, effect of down range displacement of the burnout point, errors in burn-out flight-path angle, down range errors caused by incorrect burnout height and in correct speed at burnout. The effect of earth rotation- compensating for the initial velocity of missile due to earth rotation, compensating for movement of the target due to earth rotation.

UNIT- VI

RESTRICTED THREE BODY PROBLEM

Introduction, equations of motion, Lagrangian points, stability of the Lagrangian points, Jacobi's integral, accessible regions.

UNIT- VII

LUNAR TRAJECTORIES

The Earth-moon system- orbital elements of the moon, simple Earth-Moon trajectories- some simplifying assumptions, time of flight versus injection speed, minimum energy trajectory, miss distance at the Moon caused by injection errors. The patched conic approximation- geocentric departure orbit, conditions at the patch point, selenocentric arrival orbit. Non-coplanar lunar trajectories-some typical constraints on lunar trajectories, determining the geocentric sweep angle. Selecting an acceptable launch date.

UNIT- VIII

INTERPLANETARY TRAJECTORIES

Patched-conic approximation-heliocentric transfer orbit, phase angle at departure, escape from the earth's sphere of influence, arrival at the target planet, effective collision cross-section. Locating the planets- launch opportunity, synodic period, trajectory type and class, ephemeris calculations, Non-coplanar interplanetary trajectories, Gravity-assist manoeuvre. Fast interplanetary trajectories.

TEXT BOOKS

1 Bate, R.R., Mueller, D.D. and White, J.E., *Fundamentals of Astrodynamics*, Dover Publications Inc., New York, 1971.

2 Chobotov, V.A., ed, *Orbital Mechanics* 3rd edn., AIAA Education Series, 2002.

REFERENCES

1. Wiesel, W.E., *Space?ight Dynamics,* 2nd edn., McGraw-Hill, New York, 1995.

2. Hale, F.J., *Introduction to Space Flight,* Prentice Hall, 1994.

3. Sellers, J.J., *Understanding Space: An Introduction to Astronautics*, 2nd edn., McGraw-Hill, 2004.

4. Cornelisse, J.W., *Rocket Propulsion and Spaceflight Dynamics,* Pitman Publishing, 1979.

5. Vallado, D.A., *Fundamentals of Astrodynamics and Applications*, 2nd edn., Microcosm, Inc., 2001.

6. Brown, C.D., *Spacecraft Mission Design*, 2nd edn., AIAA Education Series, 1998.

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IV Year B.Tech. AE. I Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(57122) EXPERIMENTAL AERODYAMICS (ELECTIVE-II)

UNIT-I

AERODYNAMIC EXPERIMENTS- HISTORY, MODEL TESTNG

Forms of aerodynamic experiments- observation, measurement- objectives. History, means. Model testing- wind tunnel- principles- scaling laws, scale parametes- significance.

UNIT-II

WIND TUNNELS- TYPES, APPLICATION

Wind tunnels- low speed- types, description. High speed tunnels- transonic, supersonic, hypersonic, shock tubes, special tunnels- low turbulence, high Re, environmental, automobile- function, distinctive features, application. Major wind tunnel facilities- description, details.

UNIT-III

LOW SPEED WIND TUNNELS- CONSTRUCTION, COMPONENTS, PERFORMANCE

Low speed wind tunnel- principal components- working section, diffuser, corners, turning vanes, fan, straighteners, honeycombs, screens, contraction cone, fan, motor- function, description, design requirements, constraints, construction, performance- loss coefficients. Wind tunnel performance- flow quality, power losses.

UNIT-IV

WIND TUNNEL CORRECTIONS

Wind tunnel corrections. Sources of inaccuracies- bouyancy, solid blockage, wake blockage, streamline curvature- causes, estimation, correction. Total correction on airspeed, dynamic pressure, zero lift drag.

UNIT-V

LOAD MEASUREMENTS- WIND TUNNEL BALANCES

Load measurements- wind tunnel balances, types, description, application.

UNIT-VI

FLOW MEASUREMENTS- INSTRUMENTATION

Steady and unsteady pressure measurements and various types of pressure probes and transducers, errors in pressure measurements; measurement of temperature using thermocouples, resistance thermometers, temperature sensitive paints and liquid crystals; measurement of airspeed, flow direction, boundary layer profile using Pitot static tubes, 5 hole probes, total head rake- function, working principle, types, details of design and construction, use.

UNIT-VII

FLOW VISUALISATION TECHNIQUES

Flow visualisation- need, types- tufts, china clay, oil film, smoke- working principle, description, setting up, operation, observation, recording, interpretation of imagery, relative merits, applications. High speed flows- optical methods- shadowgraphy, Schleiren, interferometry.

UNIT-VIII

MEASUREMENT OF VELOCITY- HOTWIRE ANEMOMETRY, LASER DOPPLER ANEMOMETRY, PARTICLE IMAGE VELOCIMETRY - OVERVIEW

Hot Wire Anemometry, Laser Doppler Anemometry, Partcle Image Velocimetry- working principles, description of equipment, experimental setup, settings, calibration, measurement, data processing, applications.

TEXT BOOKS

1. Low Speed Wind Tunnel Testing, Barlow, J.B., Rae, W.H., Pope, A., Wiley 1999.
2. High Speed Wind Tunnel Testing, Pope, A. and Goin, K.L., Wiley, 1965.
3. Yang, W.J., *Handbook of Flow Visualization,* 2nd edition, Taylor and Francis, 2001.

REFERENCES

1. Bradshaw, P., *Experimental Fluid Mechanics,* Pergamon Press, 1970.
2. Goldstein, R.J., (Ed.) *Fluid Mechanics Measurements*, Taylor Francis, Washington 1996. 84.
3. Tropea, C., Yarin, A. L., Foss, J. F., *Handbook of Experimental Fluid Mechanics*, Springer, 2007.

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IV Year B.Tech. AE. I Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(57123) NUMERICAL METHODS
(ELECTIVE-II)

UNIT-I

ROOTS OF NON LINEAR EQUATIONS

Solution of Algebraic and Transcendental Equations: Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

Unit-II

SOLUTION OF LINEAR EQUATIONS

Existence of solution – Gauss Elimination method – Gauss elimination with Pivoting Gauss Jordon Method- Ill conditioned systems – Jacobi iterative method – Gauss Seidel Method – Convergence of Iterative methods.

UNIT-III

INTERPOLATION

Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences – Symbolic relations and separation of symbols- Difference Equations - Differences of a polynomial-Newton's formulae for interpolation –Interpolation with unevenly spaced points- Lagrange's Interpolation formula. - Cubic spline.

UNIT-IV

LEAST SQUARES METHOD

Linear, Non linear and curvilinear curve fitting – Multiple linear regression

UNIT–V

NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation and integration Trapezoidal rule, simpson's 1/3 rule and 3/8th rule.

UNIT–VI

NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS IN ORDINARY DIFFERENTIAL EQUATIONS

Numerical solution of ordinary differential equations- solution by Taylor's series- Picard's method of successive approximations- Euler's method-

Runge-Kutta Methods –Predictor-corrector methods- Adams- Bashforth method.

UNIT-VII

BOUNDARY VALUES & EIGEN VALUE PROBLEMS

Shooting method, Finite difference method and solving Eigen values problems, power method.

UNIT-VIII

SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of partial differential equation –Finite difference methods for Elliptic equations, Laplace equations – Leibmann's iterative method – Parabolaic equations – Solution of heat equation (one dimensional).

TEXT BOOKS

1 Balaguruswamy, E., *Numerical Methods,* Tata– McGraw-Hill.

2 Sastry, S.S., *An Introduction to Numerical Analysis* – PHI Learning.

3 Jain, Iyengar & Jain, *Numerical Methods.*

REFERENCES

1. Armugam, S. et al., *Numerical Methods*, Scitech.
2. Aitkinson, K.E., *Introduction to Numerical Analysis*, Wiley Publications.
3. Scarborough, *Numerical Analysis*, Oxford IVH.
4. Gupta, R.S., *Elements of Numerical Analysis*, McMillan.
5. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. I Semester

L	T/P/D	C
3	1/-/-	3

(57124) AIRCRAFT MAINTENANCE ENGINEERING (ELECTIVE-II)

UNIT-I

NECESSITY TO DO MAINTENANCE

Definition of maintenance, role of the engineer, role of the mechanic, two types of maintenance, reliability, redesign, failure rate patterns, other maintenance considerations, establishing a maintenance program. Goals and objectives of maintenance, Discussion of the five objectives

UNIT-II

DEVELOPMENT OF MAINTENANCE PROGRAMS

Maintenance Steering Group(MSG) Approach, Process-Oriented maintenance, Task-oriented maintenance, Current MSG process-MSG-3, Maintenance program documents, maintenance intervals defined, changing basic maintenance intervals, maintenance program content

UNIT-III

AVIATION INDUSTRY CERTIFICATION REQUIREMENTS AND DOCUMENTATION FOR MAINTENANCE

Aircraft certification, delivery inspection, operator certification, certification of personnel, aviation industry interaction; Types of documentation, manufacturer's documentation, regulatory documentation, airline generated documentation, ATA document standards, closer look of TPPM

UNIT-IV

REQUIREMENTS FOR A MAINTENANCE PROGRAM AND MAINTENANCE AND ENGINEERING ORGANIZATION

Objectives of a maintenance program, Outline of aviation maintenance program, summary of FAA requirements, additional maintenance program requirements; Organization of maintenance and engineering, organization

structure, M&E organization chart, general groupings, Managerial Level Functions-technical services, aircraft maintenance, overhaul shops, material, maintenance program evaluation directorates, summary of management levels, organization structure and TPPM, variations from the typical organization

UNIT-V

TECHNICAL SERVICES

Engineering: makeup of engineering, mechanics and engineers, engineering department functions, engineering order preparation; Production Planning & Control-forecasting, production planning, production control, feedback for planning, organization of PP&C; Technical Publications-functions of technical publications, airline libraries, control of publications, document distribution; Technical Training-organization, training for aviation maintenance, airframe manufacturer's training courses, other airline training courses; Computer support-airlines uses of computers

UNIT-VI

MAINTENANCE AND MATERIAL SUPPORT

Line Maintenance(on-aircraft)-makeup of line maintenance, functions that control maintenance, maintenance control centre responsibilities, general line maintenance operations, aircraft logbook, ramp and terminal operations, other line maintenance activities, line station activities, maintenance crew requirements, morning meeting; Hangar Maintenance(on-aircraft)-organization of hangar maintenance, problem areas in hangar maintenance, maintenance support shops, ground support equipment, typical C-check; Maintenance overhaul shops(off-aircraft)-organization, types and operation of overhaul shops,

Shop data collection; Material support-organization and function of material, material directorate, M&E support functions

UNIT-VII

OVERSIGHT FUNCTIONS

Quality Assurance-requirements for QA, quality audits, ISO 9000 quality standard, technical records, other functions of QA; Quality Control-quality control organization, FAA and JAA differences, QC inspector qualifications,

basic inspection policies, other QC activities; Reliability-definition and types of reliability, elements of a reliability program, administration and management of reliability program; Maintenance Safety-industrial safety, safety regulations, maintenance safety program, general responsibility for safety, general safety rules, accident and injury reporting

UNIT-VIII

HUMAN FACTORS IN MAINTENANCE, ART AND SCIENCE OF TROUBLESHOOTING

Systematic and systems approach, systems engineering definition, system interface control, system optimization; Human factors definition, human factors and systems engineering, goals of the system and goals of the user, designing for the human interface, human factors in maintenance, human factors responsibilities, safety; Three levels of trouble shooting, knowledge of malfunctions, knowledge is power, building your own knowledge base, understanding the sequence of events, eight basic concepts of troubleshooting

TEXT BOOKS

1. Kinnison, H.A., *Aviation Maintenance Management*, McGraw-Hill, 2004.
2. McKinley, J. L., Bent, R.D., *Maintenance and Repair of Aerospace Vehicles*, Northrop Institute of Technology, McGraw Hill, 1967.

REFERENCES

1. Friend, C.H., *Aircraft Maintenance Management*, Longman, 1992.
2. Kroes, M., Watkins, W., and Delp, F. *Aircraft Maintenance and Repair*, Tata McGraw-Hill, 2010.
3. Patankar, M.S. And Taylor, J.C., Risk Management and Error Reduction in Aviation Maintenance, Ashgate, 2004, ISBN 0-7546-1941-9.

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IV Year B.Tech. AE. I Semester

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0	-/3/-	2

(57629) COMPUTATIONAL STRUCTURES LAB

1, 2. Introduction to the features and application of any one of the professional software employed in modelling and analysis of aircraft structures.

MODELING, ANALYSIS (MAXIMUM STRESSES, DEFLECTIONS) AND CODE DEVELOPMENT, OF STRUCTURAL ELEMENTS UNDER ARBITRARY STATIC LOADING- VALIDATION OF SOLUTIONS WITH PROFESSIONAL SOFTWARE

3. Bending of uniform cantilever beams.
4. Compressive strength of rectangular stiffened plane panels of uniform cross-section.
5. Shear and torsion of stiffened thin walled open and closed sections.
6. Statically indeterminate trusses.
7. Free vibrations of uniform cantilever beams- determination of natural frequencies and mode shapes.

MODELING AND ANALYSIS OF SIMPLE AIRCRAFT COMPONENTS USING PROFESSIONAL SOFTWARE

8. 3 dimensional landing gear trusses.
9. Tapered wing box beams.
10. Fuselage bulkheads.

Suggested soft wares

ANSYS

NASTRAN

PATRAN

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. I Semester	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

(57630) COMPUTATIONAL AERODYNAMICS LAB

1. Introduction to any one of the suitable software employed in modelling and simulation of aerodynamics problems.

2, 3. Solution for the following equations using finite difference method (Code development):

i) One-dimensional wave equation using explicit method of Lax

ii) One-dimensional heat conduction equation using explicit method

4, 5. Generation of the following grids (Code development):

i) Algebraic grids

ii) Elliptic grids

6,7,8,9,10. Numerical Simulation of the following flow problems using commercial software packages:

i) Flow over an airfoil

ii) Supersonic flow over a wedge

iii) Flat plate boundary layer

iv) Laminar pipe flow

v) Flow past a cylinder

Suggested Software:

FLUENT

CFX

MATLAB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**-/-/-**	**3**

(58089) AVIONICS AND INSTRUMENTS

UNIT–I

AVIONICS TECHNOLOGY

Evolution of electronics. The nature of micro electronic devices- processors, memory devices. Introduction to avionics- systems integration– need- data bus systems – MIL STD 1553 bus system, ARINC 429 / ARINC 629 bus systems, optical data bus systems. Integrated modular avionics architectures – commercial off the shelf systems. Avionics packaging.

UNIT – II

AIRCRAFT INSTRUMENTATION - SENSORS AND DISPLAYS

Air data sensors, magnetic sensing, inertial sensing, radar sensors. The electromechanical instrumented flight deck, early flight deck instruments, attitude direction indicator, horizontal situation indicator, altimeter, airspeed indicator. Advanced flight deck display system architectures, display systems, display media, future flight deck displays.

UNIT–III

COMMUNICATION AND NAVIGATION AIDS

Radio frequency spectrum, communication systems, HF, VHF, satellite communications. ATC transponder, traffic collision avoidance system. Navigational aids. Automatic Direction Finding, VHF Omni Range, Distance Measuring Equipment. TACAN, VORTAC. Satellite navigation systems – the GPS. Instrument landing system, transponder landing system, microwave landing system. Hyperbolic navigation systems.

UNIT–IV

NAVIGATION

Basic navigation, radio, inertial navigations, satellite navigation- GPS, differential GPS, wide area augmentation systems, local area augmentation system, GPS overlay programme. Integrated navigation, sensor usage. Flight management system(FMS). FMS control and display unit. Lateral navigation, area navigation, terminal navigation, vertical navigation, four dimensional

navigation, full performance based navigation. FMS procedures. Standard terminal arrival routes. ILS approach.

UNIT – V

FLIGHT CONTROL SYSTEMS

Interrelationships of flight control functions. Flight control frames of reference. Flight control actuation. Flight control and monitoring requirements. Fly-by-wire (FBW) systems. Airbus implementation. Boeing implementation. Example: Boeing 777 flight control system. Autopilot flight director systems. Autopilot modes. Integrated autopilot systems. Autoland system. Airbus -380 FBW. Flight data recorders.

UNIT – VI

FUTURE AIR NAVIGATION SYSTEMS

Terrain awareness and warning system (TAWS). Ground proximity warning system (GPW) and extended GPW (EGPW). The aims of air traffic management. Future improvements in air traffic management. Improvements in communications – air-ground data link, air-ground SATCOM communications. Improvements in navigation performance. Actual navigation performance, required navigation performance. RNAV standards, path definition error.

UNIT- VII

MILITARY AIRCRAFT ADAPTATION

Avionic and mission system interface- navigation and flight management. Navigation aids, flight deck displays, communications, aircraft systems. Applications – personnel, material and vehicle transport, air-to-air refuelling, maritime patrol, airborne early warning, ground surveillance. Electronic warfare – the EW Spectrum, electronic support measures, electronic countermeasures, electro-optics and the infra-red.

UNIT- VIII

AIRBORNE RADAR, ASTRIONICS - AVIONICS FOR SPACECRAFT

Propagation of Radar waves- functional elements of radar- antenna-transmitter. Types of Radar- Pulse Doppler- civil aviation applications, military applications.

Attitude determination & control of spacecraft- magnetometers, sun sensors, star trackers, earth and horizon sensors. Command and telemetry systems.

TEXT BOOKS

1. Moir, I. and Seabridge, A., *Civil Avionics Systems*, AIAA Education Series, AIAA, 2002, ISBN 1-56347589-8.
2. Collinson, R.P.G., *Introduction to Avionics Systems*, second edition, Springer, 2003, ISBN 978-81-8489-795-1
3. Moir, I., Seabridge, A. & Jukes, M., *Military Avionics Systems (Aerospace)*, Wiley, 2006, ISBN-10: 0470016329, ISBN-13: 9780470016329
4. Middleton, D.H. (Ed), *Avionics Systems*, Longman Scientific & Technical, 1989, ISBN 0-582-01881-1.

REFERENCES

1. Kayton, M., & Fried, W.R., *Avionics Navigation Systems*, Wiley, 1997, ISBN 0-471-54795-6.
2. Helfrick, A., *Principles of Avionics*, Avionics Communications Inc. Leesburg, 2000, VA 20177, USA, ISBN 1-885544-10-3.
2. Moir, I. and Seabridge, A., *Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration*, AIAA Education Series, AIAA, 2001, ISBN 1-56347506-5.
3. Harris, D., *Ground Studies for Pilots: Flight Instruments and Automatic Flight Control Systems*, sixth edition, Blackwell Science, 2004, ISBN 0-632-05951-6.
4. Henderson, M. F., *Aircraft Instruments & Avionics for A &P Technicians*, Jeppesen Sanderson Training Products, 1993, ISBN 0-89100-422-X.
5. Avionics Systems – *Operation & Maintenance*, 1994, Wasson, J. W., Jeppesen Sanderson Training Products, ISBN 0-89100-436-X.
6. Pallett, E.H.J., *Aircraft Instruments & Integrated Systems*, 1996, Longman Scientific & Technical.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	L	T/P/D	C
	3	1/-/-	3

(58090) AIRPORT PLANNING AND OPERATIONS (ELECTIVE-III)

UNIT-I

AIRPORT AS AN OPERATIONAL SYSTEM

Private airports and public use airports, commercial service airports and primary commercial service airports, general aviation airports, reliever airports. Hub classification- large hubs, medium hubs, small hubs, non-hubs. Components of an airport- airside, landside. Airport as a system- function of the airport- complexity of airport operation.

UNIT-II

AIRPORT PLANNING

Airport system planning, airport master plan, airport layout plan- forecasting, facilities requirements, design alternatives. Financial plans, land use planning, environmental planning.

UNIT-III

GROUND HANDLING

Passenger handling, ramp handling- aircraft ramp servicing, ramp layout. Departure control. Division of ground handling responsibilities. Control of ground handling efficiency.

UNIT-IV

BAGGAGE HANDLING

Baggage operations-operating characteristics of baggage handling systems-inbound baggage system, outbound baggage system-operating performance-organizing for the task.

UNIT-V

PASSENGER TERMINAL OPERATIONS

Functions of the passenger terminal, philosophies of terminal management. Direct passenger services, airline related passenger services. Airline related operational functions. Governmental requirements-non-passenger related airport authority functions, processing very important persons. Passenger

information systems. Space components and adjacencies- aids to circulation-hubbing considerations.

UNIT-VI

CARGO OPERATIONS

Air cargo market- expanding the movement. Flow through the cargo terminal-unit loading devices.-Handling within the terminal-Cargo apron operation-Computerisation of facilitation-Examples of modern cargo designs-Freight operations for the integrated carrier.

UNIT-VII

AIRPORT TECHNICAL SERVICES

Scope of technical services- air traffic control- telecommunications-meteorology- aeronautical information.

UNIT-VIII

AIRPORT ACCESS

Access as part of airport system- access users and modal choice, access interaction with passenger terminal operation, access modes- in-town and off-airport terminals. Factors affecting access mode choice.

TEXT BOOKS

1. Wells, A.T. and Young, S.B., *Airport Planning and Management*, 5th edn, McGraw-Hill, 2004.
2. Ashford, N., Stanton, H. P. M. and Moore, C.A., *Airport Operations*, McGraw-Hill, 1997.

REFERENCES

1. Kazda, A. and Caves, R.E., *Airport Design and Operation*, 2nd edn., Elsevier, 2007.
2. *Horonjeff, R., McKelvey, F.X., Sproule, W.J. and Young, S.B., Planning and Design of Airports*, 5th edn., McGraw-Hill, 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	L	T/P/D	C
	3	1/-/-	3

(58091) ANALYSIS OF COMPOSITE STRUCTURES (ELECTIVE–III)

UNIT-I

PROPERTIES OF CONSTITUENT MATERIALS

Introduction to laminated composite plates- mechanical properties of constituent materials such as matrices and filaments of different types.

UNIT-II

PROPERTIES OF COMPOSITE LAMINATES

Netting analysis of composite materials, determination of properties of laminates with fibers and matrices.

UNIT-III

ELASTIC PROPERTIES

Stress-strain relations of isotropic, orthotropic and anisotropic materials, transformation of material properties for arbitrary orientation of fibers.

UNIT-IV

METHODS OF ANALYSIS-I

Mechanics of materials approach to determine Young's modulus, shear modulus and Poisson's ratio. Brief mention of elasticity approach and macro mechanics of laminates

UNIT-V

METHODS OF ANALYSIS-II

Anisotropic elasticity, stress –strain relations in material coordinates - Transformation of geometric axes, strength concepts, biaxial strength theories, maximum stress and maximum strain.

UNIT-VI

ANALYSIS OF LAMINATED BEAMS AND PLATES

Classical plate theory, Classical lamination theory – Special cases of single

layer, symmetric, antisymmetric & unsymmetric composites with cross ply, angle ply lay up. Deflection analysis of laminated plates, Analysis of laminated beams and plates.

UNIT-VII

SHEAR DEFORMATION ANALYSIS

Shear deformation theories for composite laminated beams, plates- first, second and third order theories. nth order theory.

UNIT-VIII

BUCKLING ANALYSIS

Buckling analysis of laminated composite plates with different orientation of fibers, Tsai-wu criteria and Tsai – Hill Criteria

TEXT BOOKS

1. Agarwal B. D., Broutman. L. J., *Analysis and Performance of Fibre Composites*, John Wiley and sons – New York, 1980.
2. Lubin. G, *Hand Book on Advanced Plastics and Fibre Glass*, Von. Nostrand, Reinhold Co. New york, 1989.

REFERENCES

1. Gupta, L., *Advanced Composite Materials,* Himalayan Books, New Delhi, 1998.
2. Jones, R.M., *Mechanics of Composite Materials,* McGrawHill Kogakusha, ltd. Tokyo.
3. Reddy, J.N., *Mechanics of Composite Materials*,

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IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(58092) HELICOPTER ENGINEERING
(ELECTIVE-III)

UNIT - I

ELEMENTS OF HELICOPTER AERODYNAMICS

Configurations based on torque reaction - Jet rotors and compound helicopters.

UNIT – II

ROTOR CONTROL

Methods of control - Collective and cyclic pitch changes - Lead-lag and flapping hinges.

UNIT - III

IDEAL ROTAR THEORY

Hovering performances - Momentum and simple blade element theories.

UNIT – IV

ROTOR PERFORMANCE

Figures of merit - Profile and induced power estimation - Constant chord and ideal twist rotors.

UNIT - V

POWER ESTIMATES

Induced, Profile and Parasite power requirements in forward flight - Performances curves with effects of altitude.

UNIT – VI

STABILITY AND TRIM

Preliminary ideas on helicopter stability.

UNIT - VII

LIFT AND CONTROL OF V/STOL AIRCRAFT

Various configuration - Propeller, Rotor ducted fan and jet lift - Tilt wing and

vectored thrust - Performances of VTOL and STOL aircraft in hover, Transition and Forward motion.

UNIT - VIII

GROUND EFFECT MACHINES

Types - Hover height, Lift augmentation and power calculations for plenum chamber and peripheral jet machines - Drag of hovercraft on land and water. Applications of hovercraft.

TEXT BOOKS

1. Johnson, W., Helicopter Theory, Princeton University Pres, 1980.
2. McCormick, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley, 1995

REFERENCES

1. Gessow, A., and Myers, G.C., Aerodynamics of Helicopter, Macmillan & Co., N.Y.1987.
2. McCormick, B.W., Aerodynamics of V/STOL Flight, Academics Press, 1987
3. Gupta, L Helicopter Engineering, Himalayan books, 1996.

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IV Year B.Tech. AE. II Semester

L	T/P/D	C
3	1/-/-	3

(58093) HYPERSONIC AERODYNAMICS (ELECTIVE-III)

UNIT-I

INTRODUCTION

History of hypersonic flight- a logical progression in the light of advancing technical findings. Hypersonic flow- definition, importance, physical aspects. Brief descriptive introductory pre-view of various phenomena such as Thin shock layer, Entropy layer, Viscous interaction, Effects of high temperature and communication black out. Low density flow, free molecular flow.

UNIT-II

HYPERSONIC SHOCK AND EXPANSION WAVE RELATIONS

Oblique shock relations for high Mach numbers, Expansion wave relations for high Mach numbers. Theoretical basis of Mach number independence principle- corroboration by experimental results. Importance of experiments.

UNIT-III

LOCAL SURFACE INCLINATION METHODS

Newtonian flow and the hypersonic double limit of M&1, Modified Newtonian flow, Centrifugal force correction to Newtonian flow, Tangent wedge and tangent cone methods.

UNIT-IV

HYPERSONIC INVISCID FLOWS-I

Hypersonic small disturbance theory, Equivalence principle and hypersonic similarity parameter; Hypersonic shock relations in terms of similarity parameter.

UNIT-V

HYPERSONIC INVISCID FLOWS–II

Application of small disturbance theory and equivalence of 1-dimensional piston motion with 2-dimansional hypersonic flow, Flat plate at an angle of attack by piston theory and comparison with exact shock expansion method,

Bi-convex airfoil at zero angle of attack: comparison of piston theory and exact shock expansion method, Phenomenological aspects of hypersonic blunt body problem, Importance of blunt body problem and brief outline of computational time-marching finite difference method and its advantage over other methods.

UNIT–VI

VISCOUS FLOWS

Derivation of compressible boundary layer equations, Brief introduction to the flat plate case and some important results and conclusions for high Mach number flows, Special characteristics of hypersonic boundary layers, Introduction to hypersonic interaction parameters – weak & strong.

UNIT–VII

SHOCK TUBE BASED EXPERIMENTAL FACILITIES.

Shock tunnel, Gun tunnel, Free piston wind tunnel, Ludweig tube, Measurement techniques, Samples of comparison of experimental and theoretical results.

UNIT–VIII

OTHER HYPERSONIC FACILITIES

Continuous hypersonic tunnel free flight experiments in tunnels and ballistic ranges- Measurement techniques. Role of experiments in computer code validation and calibration, Brief introduction to heat transfer measurements.

TEXT BOOKS

1. Anderson J D, *Hypersonic and High Temperature Gas Dynamics*, 2nd Edition, AIAA Education series, 2000.
2. Hayes & Probstein, *Hypersonic Flow Theory.*
3. Bertin, J. J. , *Hypersonic Aerothermo-dynamics*, AIAA Education series, 1994.
4. Spurk, J., *Fluid Mechanics,* Springer, Heidelberg, 1997.

REFERENCES

1. Wendt J F, *European Hypersonic Wind Tunnels,* AGARD Conference Proceedings No. 428, Nov. 1987, Paper 2.
2. Canning T. N., Seiff A. and James, C. S., *Ballistic Range Technology,*

AGARDograph Report AD 07 13915, Aug. 1970.

3. Brun, Raymond, *Introduction to Reactive Gas Dynamics*, Oxford Univ. Press, 2009, Chapter 11: Facilities and Experimental Methods.

4. Harry J Davies, H.J. and Churchack, H.D., *Shock Tube Techniques & Instrumentation*, 1969, US Army Material Command, Harry Diamond Lab, Washington DC (available on net – Free Copy).

5. Burtschell, Y., Brun, R., and Zeitoun, D., *Shock Waves*. Springer Verlag, Berlin, 1992.

6. *An Album of Supersonic Flow Visualization*, Edited by P I Kovalev & N P Mende, National Defence industry press (Write to Prof S V Bobashev, 26 politechnicheskaya street, St. Petersburg 194021, Russia).

7. Curtis, P. *Shock tubes*, Pegasus Eliot Mackenzie Publishers, October 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(58094) HEAT TRANSFER
(ELECTIVE-IV)

UNIT – I

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

UNIT – II

Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation.

One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity – systems with heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

UNIT III

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Concept of Functional Body

UNIT – IV

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat

transfer -Flat plates and Cylinders.

Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

UNIT – V

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.

UNIT VI

Heat Transfer with Phase Change: Boiling: – Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling. **Condensation:** Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

UNIT VII

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT VIII

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

TEXT BOOKS

1. Holman, *Heat Transfer,* TMH
2. Nag, P.K., *Heat Transfer,* TMH

REFERENCES

1. Sachdeva, R.C., *Fundamentals of Engineering Heat and Mass Transfer,* New Age International
2. Ghoshdastidar, *Heat Transfer,* second edition, Oxford University Press.

3. Cengal, *Heat and Mass Transfer,* McGraw Hill.
4. Rajput, R.K., *Heat and Mass Transfer,* S.Chand & Company Ltd.
5. Long, C.A., *Essential Heat Transfer,* Pearson Education
6. Kumar, D.S., *Heat and Mass Transfer.* S.K.Kataria & Sons
7. Kodandaraman, *Heat and Mass Transfer.*
8. Incropera & Dewitt, *Fundamentals of Heat Transfer & Mass Transfer,* John Wiley Pub.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

(58095) LAUNCH VEHICLE AND MISSILE TECHNOLOGY
(ELECTIVE-IV)

UNIT-I

INTRODUCTION

Space launch vehicles and military missiles- function, types, role, mission, mission profile, thrust profile, propulsion system, payload, staging, control and guidance requirements, performance measures, design, construction, operation- similarities and differences. Some famous space launch vehicles and strategic missiles.

UNIT-II

SOLID PROPELLANT ROCKET MOTOR SYSTEMS

Solid propellant rocket motors, principal features, applications. Solid propellants, types, composition, properties, performance. Propellant grain, desirable properties, grain configuration, preparation, loading. Structural design of grain. Liners, insulators and inhibitors- function, requirements, materials. Rocket motor casing- materials. Nozzles- types, design, construction, thermal protection. Igniters, types, construction. Description of modern solid boosters I) Space Shuttle SRB, ii) the Arienne SRB.

UNIT-III

LIQUID PROPELLANT ROCKET ENGINE SYSTEMS

Liquid propellants- types, composition, properties, performance. Propellant tanks, feed systems- pressurisation, turbo-pumps- valves and feed lines, injectors, starting and ignition. Engine cooling, support structure. Control of engine starting and thrust build up, system calibration, integration and optimisation- safety and environmental concerns. Description of the Space Shuttle main engine. Propellant slosh, propellant hammer, geysering effect in cryogenic rocket engines.

UNIT-IV

AERODYNAMICS OF ROCKETS AND MISSILES

Classification of missiles. Airframe components of rockets and missiles, Forces acting on a missile while passing through atmosphere, method of describing

aerodynamic forces and moments, lateral aerodynamic moment, lateral damping moment, longitudinal moment of a rocket, lift and drag forces, drag estimation, body upwash and downwash in missiles. Rocket dispersion, re-entry body design considerations

UNIT-V

LAUNCH VEHICLE DYNAMICS

Tsiolskovsky's rocket equation- range in the absence of gravity, vertical motion in the earth's gravitational field, inclined motion, filght path at constant pitch angle, motion in the atmosphere, the gravity turn- the culmination altitude. Multi staging. Earth launch trajectories- vertical segment, the gravity turn, constant pitch trajectory, orbital injection. Actual launch vehicle trajectories- types. Examples, the Mu 3- S- II, Ariane, Pegasus launchers. Reusable launch vehicles- future launchers- launch assist technologies

UNIT-VI

ATTITUDE CONTROL OF ROCKETS AND MISSILES

Rocket thrust vector control-methods of thrust vector control for solid and liquid propulsion systems, thrust magnitude control, thrust termination; Stage separation dynamics, separation techniques

UNIT-VII

ROCKET TESTING

Ground testing and flight testing- types of tests, test facilities and safeguards, monitoring and control of toxic materials, instrumentation and data management. Ground testing, flight testing, trajectory monitoring, post accident procedures. Description of a typical space launch vehicle launch procedure.

UNIT-VIII

MATERIALS

Criteria for selection of materials for rockets and missiles- requirements for choice of materials for propellant tanks, liners, insulators, inhibitors, at cryogenic temperatures, requirements of materials at extremely high temperatures, requirements of materials for thermal protection and for pressure vessels.

TEXT BOOKS

1. Sutton, G.P., and Biblarz, O., *Rocket Propulsion Elements*, 7th edition, Wiley-Interscience, 2000.
2. Cornelisse, J.W., Schoyer H.F.R. and Wakker, K.F., *Rocket Propulsion and Space-flight Dynamics,* Pitman, 1979.
3. Turner, M.J.L., *Rocket and Spacecraft Propulsion*, Springer, 2001.

REFERENCES

1. Chin, S.S., *Missile Configuration Design,* McGraw Hill, 1961
2. Ball, K.J., Osborne, G.F., *Space Vehicle Dynamics*, Oxford University Press, 1967.
3. Parker, E.R., *Materials for Missiles and Spacecraft,* McGraw Hill, 1982.
4. Mouritz, A. and Bannister, M., *Introduction to Aerospace Materials*, CRC Press, 2010

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester

L	T/P/D	C
3	1/-/-	3

(58096) WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS (ELECTIVE-IV)

UNIT-I

ATMOSPHERIC WINDS

Causes of wind- thermal drive, Coriolis effect, pressure gradient effect. Geotrophic winds.

UNIT–II

ATMOSPHERIC BOUNDARY LAYER

Land and sea breeze,mountain winds, thermals, cause of turbulence at ground level. Atmospheric boundary layer, velocity profile laws- effect of terrain on atmospheric boundary layer. Wind tunnels- basic features and components. Wind tunnel models- role of non-dimensional groups. Creation of atmospheric boundary layer type flow in a wind tunnel.

UNIT–III

WIND ENERGY-I

Ship propulsion- sails- lift and drag translators- modern yachts. Horizontal (HAWT) and vertical axis (VAWT) wind turbines- history, classification. Power coefficient, torque coefficient- elementary actuator disc theory- Betz coefficient.

UNIT-IV

WIND ENERGY-II

Working principle and power coefficients of conventional horizontal axis wind turbines, avonious vertical axis wind turbines, Darrieus vertical axis wind turbines. Introduction to blade element theory.

UNIT-V

VEHICLE AERODYNAMICS

Power requirements and drag coefficients of automobiles- causes of vortex formation and drag- effects of cut back angle- racing cars, commercial transport vehicles- buses, trucks, driver cabin and trailer combinations.

UNIT– VI

BUILDING AERODYNAMICS

Pressure distribution on low-rise buildings, Wind forces on buildings, Environmental winds in city blocks- special problems of tall buildings, Building codes, building ventilation and architectural aerodynamics. Interference effect of building.

UNIT– VII

FLOW INDUCED VIBRATIONS

Effects of Reynolds number on wake formation of bluff shapes. Vortex induced vibrations, galloping of transmission lines and stall flutter.

UNIT – VIII

DESIGN OF CHIMNEY

Height of chimney for various gas effluents, Effective height of chimney, flume rise, Different types of flume rise for various climatic conditions.

TEXT BOOKS

1. Blevins, R.D., Flow Induced Vibrations, Van Nostard, 1990.
2. Calvert, N.G., Wind Power Principles, Charles Griffin & Co., London, 1979.

REFERENCES

1. Scorer, R.S., *Environmental Aerodynamics,* Ellis Harwood Ltd, England, 1978.
2. Sovran, M., *Aerodynamics Drag Mechanisms of Bluff Bodies and Road Vehicles*, Plenum Press, N.Y., 1978.
3. Sachs. P., *Wind Forces in Engineering*, Pergamon Press, 1988.

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IV Year B.Tech. AE. II Semester

L	T/P/D	C
3	1/-/-	3

(58097) AEROELASTICITY
(ELECTIVE-IV)

UNIT I

INTRODUCTION

Interaction of aerodynamic, structural and inertial forces. Collar's triangle. Static and dynamic aeroelasticity phenomena.

UNIT II

IDEALISED FLOW OVER WINGS

Simple two dimensional idealization of flow over wings- strip theory. Fredholm integral equations of second kind, exact solutions for simple rectangular wings.

UNIT III

STRUCTURAL DYNAMICS

Formulations of structural dynamics equation and coupling effects for panels and plates. Generalized coordinates, Lagrange's equations of motion, Hamilton's principle- orthogonality conditions.

UNIT IV

STATIC AEROELASTICITY- DIVERGENCE, CONTROL REVERSAL

Static aeroelastic studies- divergence, control reversal- aileron reversal speed, aileron efficiency, lift distribution- rigid and elastic wings.

UNIT V

DIMENSIONAL SIMILARITY

Nondimensional parameters, stiffness criteria, dynamic mass-balancing - model experiments and dimensional similarity– flutter analysis.

UNIT VI

MODAL EQUATIONS

Formulation of aeroelastic equations for a typical section- quasi steady

aerodynamic derivatives, modal equations- Galerkins method of analysis.

UNIT VII

TORSION FLEXURE FLUTTER

Stability of motion of continua. Torsion-flexure flutter – solution of flutter determinant, method of determining the classical flutter speed – flutter prevention and control.

UNIT VIII

FLOW INDUCED VIBRATIONS

Application of aeroelasticity to engineering problems – Galloping of transmission lines, flow induced vibrations of tall slender structures and suspension bridges.

TEXT BOOKS

1. Fung, Y.C., *An Introduction to the Theory of Aeroelasticity*, John Wiley, 1985.
2. Bisphlinghoff, R. C., Ashley. H. and Halfmann, R., *Aero-elasticity*, Addition Wesley.
3. Scanlan, R.H. and Rosenbaum, R., *Introduction to the Study of Aircraft Vibrations and Flutter*, McGraw- Hill, 1981.

REFERENCE

1. Bisphlinghoff, R. C. and Ashley, H., *Principles of Aeroelasticity*, John Wiley, 1998.

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IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	0	**-/-/-**	**2**

(58657) INDUSTRY ORIENTED MINI PROJECT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	0	**-/6/-**	**2**

(58658) SEMINAR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	0	**-/15/-**	**10**

(58659) PROJECT WORK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. AE. II Semester	**L**	**T/P/D**	**C**
	0	**-/-/-**	**2**

(58660) COMPREHENSIVE VIVA-VOCE