MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

Sponsored by CMR Educational Society

(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade - ISO 9001:2008 Certified)
Maisammaguda, Dhulapally (Post Via Hakimpet), Secunderabad – 500100, Telangana State, India.
Contact Number: 040-23792146/64634237, E-Mail ID: mrcet2004@gmail.com, website: www.mrcet.ac.in

BACHELOR OF TECHNOLOGY
AERONAUTICAL ENGINEERING

ACADEMIC REGULATIONS
COURSE STRUCTURE AND SYLLABUS
(Batches admitted from the academic year 2015 - 2016)

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

PRELIMINARY DEFINITIONS AND NOMENCLATURES

- ”Autonomous Institution /College” means an institution/college designated as autonomous institute / college by University Grants Commission (UGC), as per the UGC Autonomous College Statutes.
- “Academic Autonomy” means freedom to a College in all aspects of conducting its academic programs, granted by the University for promoting excellence.
- “Commission” means University Grants Commission.
- “AICTE” means All India Council for Technical Education.
- “University” the Jawaharlal Nehru Technological University, Hyderabad.
- “College” means Malla Reddy College of Engineering & Technology, Secunderabad unless indicated otherwise by the context.
- “Program” means:
  - Bachelor of Technology (B.Tech) degree program
  - UG Degree Program: B.Tech
- “Branch” means specialization in a program like B.Tech degree program in Electronics & Communication Engineering, B.Tech degree program in Computer Science and Engineering etc.
- “Course” or “Subject” means a theory or practical subject, identified by its course – number and course-title, which is normally studied in a semester.
- T–Tutorial, P–Practical, D–Drawing, L-Theory, C-Credits

FOREWORD

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

Malla Reddy College of Engineering & Technology (MRCET) is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, and also improving upon the values and beliefs for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several experts drawn from academics, industry and research, in accordance with the vision and mission of the college which reflects the mindset of the institution in order to produce quality engineering graduates to the society.

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

"A thought beyond the horizons of success committed for educational excellence"

PRINCIPAL

ACADEMIC REGULATIONS FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2015-16 and onwards

1. Award of B. Tech. Degree

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

1.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight academic years.

1.2 After eight academic years of course of study, the candidate is permitted to write the examinations for two more years.

1.3 The candidate shall register for **192 credits** and secure **192 credits** with compulsory subjects as listed in Table-1

Table 1: Compulsory Subjects

S.No	Subject Particulars
1	All practical Subjects
2	Mini Project
3	Technical Seminar
4	Project Work

1.4 In addition to 1.3, the candidate has to register for Mandatory courses (Non-credit course), 50% of scoring is required for the award of the degree.

2. The students, who fail to fulfill all the academic requirements for the award of the degree within ten academic years from the year of their admission, shall forfeit their seats in B. Tech. course.

3. Courses of study

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

S.No	Department
01	Aeronautical Engineering
02	Computer Science Engineering
03	Electronics & Communication Engineering
04	Information Technology
05	Mechanical Engineering
06	Mining Engineering

4. Credits

Particulars	Semester	
	Periods per week	Credits
Theory	05	04
	04	03
Practical	03	02
Drawing	03	02
	06	04
Mini Project	--	04
Technical Seminar	06	02
Major Project	15	10

***Duration of each period is 50 minutes.**

5. Distribution and Weightage of Marks

5.1 The performance of a student in each semester shall be evaluated subject-wise for a maximum of 100 marks for a theory and 75 marks for a practical subject. In addition, Mini Project, Technical seminar and Major Project work shall be evaluated for 100, 50 and 300 marks, respectively.

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

5.3 For theory subjects, during a semester there shall be 2 mid-term examinations. Each mid- term examination consists of a descriptive paper and assignment. The descriptive paper shall be for 20 marks with a total duration of 2 hours. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. While the first mid-term examination shall be conducted from 1 to 2 units of the syllabus, the second mid-term examination shall be conducted from 3 to 5 units**.** Five (5) marks are allocated for Assignments (as specified by the subject teacher concerned). The first Assignment should be submitted before the conduct of the first mid-examination, and the second Assignment should be submitted before the conduct of the second mid-examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each candidate.
However, if any student is absent/scoring internal marks less than 40% in any subject of a mid-term examination he/she will be given a chance to write the internal exam once again after he/she re-registering for the internal exam in the concerned subject and paying stipulated fees as per the norms.

The end examination will be conducted for 75 marks with Part A as a compulsory question for 25 marks. Part B is for maximum of 50 marks with 5 questions consisting of two parts each (a) and (b), out of which the student has to answer either (a) or (b), not both. Each question in Part B carries 10 marks.

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

5.5 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 semester examination. There shall be two internal tests in a Semester and the average of the two shall be considered for the award of marks for internal tests.

5.6 There shall be a Mini Project to be taken up during the vacation after III year II Semester examination. However, the Mini-Project and its report shall be evaluated along with the Major Project work in IV year II Semester. The Mini Project shall be submitted in a report form and presented before the committee. It shall be evaluated for 100 marks. The committee consists of an External Examiner, Head of the Department, and the Supervisor of the Mini Project and a Senior Faculty member of the department. There shall be no internal marks for Mini Project.

5.7 There shall be a Technical 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 of the topic, and submit it to the department. It 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 the seminar.

5.8 Out of a total of 300 marks for the Major Project work, 100 marks shall be allotted for Internal Evaluation and 200 marks for the End Semester Examination (Viva Voce). The End Semester Examination of the Major Project work shall be conducted by the same committee as appointed for the mini-project. In addition, the project supervisor shall also be included in the committee. The topics for mini project, seminar and project work shall be different from one another. The evaluation of project work shall be made 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.

5.9 The Laboratory marks and the sessional marks awarded by the College are subject to scrutiny and scaling by the college wherever necessary. In such cases, the sessional and laboratory marks awarded by the College will be referred to Academic Council. The Academic Council will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the Academic Council are final and binding. The laboratory records and internal test papers shall be preserved in the College as per the Affiliation University rules and produced before the Committees/Academic Council as and when asked for.

6. Attendance Requirements

6.1 A student is eligible to write the University examinations only if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

6.2 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

6.3 Shortage of Attendance below 65% in aggregate shall not be condoned.

6.4 A student who is short of attendance in semester may seek re-admission into that semester when offered within 4 weeks from the date of the commencement of class work.

6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class and their registration stands cancelled.

6.6 A stipulated fee as determined by the examination branch shall be payable towards condonation of shortage of attendance.

6.7 **A student will be promoted to the next semester if he satisfies the attendance requirement of the present semester, as applicable, including the days of attendance in sports, games, NCC and NSS activities.**

6.8 **If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.**

7. Course Registration:

7.1 Every student has to register for a set of Courses in each Semester, with the total number of their Credits being limited by considering the permissible weekly Contact Hours (typically: 30/Week); For this, an average Course Registration of minimum 20 Credits/Semester (e.g., 6-7 Courses) and a maximum of 28 credits are generally acceptable on recommendation of concerned academic advisor by satisfying the pre-requisite conditions.

7.2 Approval of the Course Registration will be informed by the concerned Head of the Department on the beginning of the semester by taking the number of students registered (minimum **one-third** students per class) and availability of the faculty into consideration.

7.3 Dropping of the Course Registration can be permitted up to two weeks from the commencement of the semester. Thereafter no droppings are permitted.

7.4 Interchanging of Course Registrations are not permitted.

7.5 The Pre-requisite conditions for the additional course(s) registration by the students are based on the slots available in the Time Table, Class rooms and Faculty availability.

8. Minimum Academic Requirements

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

8.1 A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the mid-term and end semester exams.
8.2 A student shall be promoted from I year to II year upon fulfilling the minimum required attendance.
8.3 A student will be eligible to be promoted from II year to III year, upon fulfilling the academic requirements of 50 % credits up to II year I semester examinations and secures prescribed minimum attendance in II year.
8.4 A student will be eligible to be promoted from III year to IV year, upon fulfilling the academic requirements of 50 % credits up to III year I semester examinations and secures prescribed minimum attendance in III year.
8.5 A student shall register and put up minimum attendance in all 192 credits and shall earn a minimum of 184 credits for the award of B.Tech degree. Further, marks obtained in the 184 credits shall be considered for the calculation of percentage of marks as well as overall CGPA.
8.6 Students who fail to earn 184 credits as indicated in the course structure within ten academic years (8 years of study + 2 years additionally for appearing for exams only) from the year of their admission, shall forfeit their seat in B.Tech course and their admission stands cancelled.

9. Course pattern

9.1 The entire course of study is for four academic years. I,II, III and IV years shall be on semester pattern.

9.2 A student, eligible to appear for the end examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject during the period of supplementary exams.

9.3 When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the next semester. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

10. Award of Class

In assessing the performance of the students in examinations, the usual approach is to award marks based on the examinations conducted at various stages (sessional, mid-term, end-semester etc.,) in a semester. As per UGC Autonomous guidelines, the following system is implemented in awarding the grades and CGPA under the **Choice Based Credit System (CBCS).**

Letter Grades and Grade Points:

The UGC recommends a 10-point grading system with the following letter grades as given below:

Grades	Points	Marks secured (%)
O (Outstanding)	10	≥ 90
A+(Excellent)	9	85 – 89
A(Very Good)	8	75 – 84
B+(Good)	7	70 – 74
B(Above Average)	6	60 – 69
C(Average)	5	50 – 59
P(Pass)	4	40 – 49
F(Fail)	0	<40
Ab(Absent)	0	-

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

13.1 A student shall register and put up minimum attendance in all 192 credits and shall earn a minimum of 184 credits for the award of B.Tech degree. Further, marks obtained in the 184 credits shall be considered for the calculation of percentage of marks as well as overall CGPA ≥ 5.0, within 8 academic years from the date of commencement of the first academic year, shall be declared to have **'qualified'** for the award of the B.Tech. Degree in the chosen branch of Engineering as selected at the time of admission.

13.2 A student who qualifies for the award of the degree as listed in 13.1 shall be placed in the following classes.

13.3 Students with final CGPA (at the end of the under graduate programme) ≥ 7.50, and shall be placed in **'first class with distinction'**.

13.4 Students with final CGPA (at the end of the under graduate programme) ≥ 6.50 but < 7.50, shall be placed in **'first class'**.

13.5 Students with final CGPA (at the end of the under graduate programme) ≥ 5.50 but < 6.50, shall be placed in **'Second class'.**

13.6 All other students who qualify for the award of the degree (as per item 13.1), with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 5.50, shall be placed in **'pass class'.**

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

13.8 Students fulfilling the conditions listed under item 13.3 alone will be eligible for award of **'university rank'** and **'gold medal'.**

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

SGPA (Si) = Σ(Ci x Gi) / ΣCi

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA = Σ(Ci x Si) / Σ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

11 Minimum Instruction Days

The minimum instruction days for each semester shall be 90days.

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

13 WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

14. TRANSITORY REGULATIONS

14.1 Discontinued, detained, or failed candidates are eligible for readmission as and when next offered.

14.2 After the revision of the regulations, the students of the previous batches will be given two chances for passing in their failed subjects, one supplementary and the other regular. If the students cannot clear the subjects in the given two chances, they shall be given equivalent subjects as per the revised regulations which they have to pass in order to obtain the required number of credits.

14.3 In case of transferred students from other Universities, the credits shall be transferred to JNTUH as per the academic regulations and course structure of the MRCET.

15. General

15.1 Wherever the words he , him , his , occur in the regulations, they include she , her , hers .

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

15.3 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

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

15.5 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/Institutions, have to pass the failed subjects which are equivalent to the subjects of prescribed curriculum of the institute, and also pass the subjects of prescribed curriculum of the institute which the candidates have not studied at the earlier Institution on their own without the right to sessional marks. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of prescribed curriculum of the institute, the candidates have to study those subjects in prescribed curriculum of the institute in spite of the fact that those subjects are repeated.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	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.	Using objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-incharge, 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.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their 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.

* * * * *

PROGRAM OUTCOMES
(POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design / development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.

Life- long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: PROFESSIONALISM & CITIZENSHIP To create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, ecological and economic issues.
PEO2: TECHNICAL ACCOMPLISHMENTS To provide knowledge based services to satisfy the needs of society and the industry by providing hands on experience in various technologies in core field.
PEO3: INVENTION, INNOVATION AND CREATIVITY To make the students to design, experiment, analyze, interpret in the core field with the help of other multi disciplinary concepts wherever applicable.
PEO4: PROFESSIONAL DEVELOPMENT To educate the students to disseminate research findings with good soft skills and become a successful entrepreneur.
PEO5: HUMAN RESOURCE DEVELOPMENT To graduate the students in building national capabilities in technology, education and research.

PROGRAM SPECIFIC OBJECTIVES (PSO's)

1. To mould students to become a professional with all necessary skills, personality and sound knowledge in basic and advance technological areas.
2. To promote understanding of concepts and develop ability in design manufacture and maintenance of aircraft, aerospace vehicles and associated equipment and develop application capability of the concepts sciences to engineering design and processes.
3. Understanding the current scenario in the field of aeronautics and acquire ability to apply knowledge of engineering, science and mathematics to design and conduct experiments in the field of Aeronautical Engineering.
4. To develop leadership skills in our students necessary to shape the social, intellectual, business and technical worlds.

DEPARTMENT OF AERONAUTICAL ENGINEERING

COURSE STRUCTURE

I Year B. Tech (ANE) – I Semester

S.NO	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX.MARKS	
						Int	Ext
1	R15A0001	English	3	-	2	25	75
2	R15A0021	Mathematics-I	5	1	4	25	75
3	R15A0011	Engineering Physics-I	3	-	2	25	75
4	R15A0014	Environmental Studies	4	-	3	25	75
5	R15A0501	Computer Programming With C	4	-	3	25	75
6	R15A0301	Engineering Mechanics	5	1	4	25	75
7	R15A0581	Computer Programming Lab	-	3	2	25	50
8	R15A0084	IT Workshop/Engineering Workshop Lab	-	3	2	25	50
9	R15A0081	English Language Communication Skills Lab-I	-	3	2	25	50
*10	R15A0003	Human Values And Societal Perspectives	2	-	-	50	-
		TOTAL	26	11	24	275	600

***Mandatory course: Non-credit subject, 50% of scoring is required for the award of the degree**

I Year B. Tech (ANE) – II Semester

S.NO	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX.MARKS	
						Int	Ext
1	R15A0002	Professional English	3	-	2	25	75
2	R15A0022	Mathematics-II	5	1	4	25	75
3	R15A0012	Engineering Physics-II	3	-	2	25	75
4	R15A0013	Engineering Chemistry	4	1	3	25	75
5	R15A0502	Object Oriented Programming	4	-	3	25	75
6	R15A0302	Engineering Drawing	2	3	4	25	75
7	R15A0582	Object Oriented Programming Lab	-	3	2	25	50
8	R15A0083	Engineering Physics / Chemistry Lab	-	3	2	25	50
9	R15A0082	English Language Communication Skills Lab-II	-	3	2	25	50
		TOTAL	21	14	24	225	600

II Year B. Tech (AE) – I Semester (5 Core Subjects + 1 Open Elective + 2 Labs+1 Mandatory Subject)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R15A0362	Mechanics Of Fluids	4	1	3	25	75
2	R15A0363	Mechanics Of Solids	4	1	3	25	75
3	R15A0364	Thermodynamics	5	1	4	25	75
4	R15A2101	Aircraft Production Technology	4	-	3	25	75
5	R15A2102	Aircraft Engineering Drawing	2	3	4	25	75
6	 R15A0061 R15A0507 R15A0067	Open Elective – I Managerial Economics And Financial Accountancy Java Programming Technology Management	4	-	3	25	75
7	R15A0389	CAD Lab	-	3	2	25	50
8	R15A0384	MoS and MoF Lab	-	3	2	25	50
*9	R15A0004 R15A0005	Foreign Language : French Foreign Language : German	2	-	-	50	-
Total			**25**	**12**	**24**	**250**	**550**

***Mandatory course: Non-credit course, 50% of scoring is required for the award of the degree**

II Year B. Tech (AE) – II Semester (5 Core Subjects + 1 Open Elective + 2 Labs)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R15A2103	Aerospace Propulsion	4	1	3	25	75
2	R15A2104	Aerodynamics	4	-	3	25	75
3	R15A2105	Aerospace Vehicle Structures -I	4	1	3	25	75
4	R15A0206	Electrical And Electronics Engineering	4	-	3	25	75
5	R15A2106	Aircraft Performance	4	1	3	25	75
6	 R15A0069 R15A0065 R15A0024	Open Elective – II Intellectual Property Rights Management Sciences Probability and Statistics	4	-	3	25	75
7	R15A0006	Gender Sensitization	-	3	2	75	-
8	R15A2181	Aircraft Production Technology Lab	-	3	2	25	50
9	R15A0282	Electrical And Electronics Engineering Lab	-	3	2	25	50
Total			24	12	24	275	550

***Mandatory course: 40% of scoring in Gender Sensitization is required for the award of the degree**

III Year B. Tech (AE) – I Semester (4 Core Subjects+1 Core Elective+1 Open Elective+2 Labs)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R15A2107	Introduction To Space Technology	4	-	3	25	75
2	R15A2108	High Speed Aerodynamics	5	1	4	25	75
3	R15A2109	Aerospace Vehicle Structures -II	5	1	4	25	75
4	R15A2110	Aircraft Stability And Control	4	1	3	25	75
5	R15A2111 R15A0367 R15A0366	Core Elective – I Aerospace Materials And Composites Experimental Stress Analysis Engineering Optimization	4	-	3	25	75
6	R15A0068 R15A0365 R15A0521	Open Elective – III Total Quality Management Mechanisms & Mechanical Design Web Technologies	4	-	3	25	75
7	R15A2182	Aerodynamics and Propulsion Lab	-	3	2	25	50
8	R15A2183	Aerospace Structures Lab	-	3	2	25	50
Total			**26**	**9**	**24**	**200**	**550**

III Year B. Tech (AE) – II Semester (4 Core Subjects+1 Core Elective+1 Open Elective+2 Labs+1 Mandatory subject)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R15A2112	Finite Element Analysis	5	1	4	25	75
2	R15A2113	Control Theory for Aircraft	5	1	4	25	75
3	R15A2114	Flight Vehicle Design	4	-	3	25	75
4	R15A2115	Aircraft Systems	4	-	3	25	75
5	R15A2116 R15A2117 R15A2118	Core Elective – II Launch Vehicle And Missile Technology Air Transportation Systems Space Mechanics	4	-	3	25	75
6	R15A0371 R15A0568 R15A0062	Open Elective – IV Green Energy Systems App Design and Development Supply Chain Management	4	-	3	25	75
*7	R15A0005	Technical Communication And Soft Skills	2	-	-	50	-
8	R15A2184	Flight Vehicle Design and Instrumentation Lab	-	3	2	25	50
9	R15A2185	Programming Language For Mathematical Models	-	3	2	25	50
Total			28	8	24	250	550

***Mandatory course: Non-credit course, 50% of scoring is required for the award of the degree**

IV Year B. Tech (AE) – I Semester (4 Core Subjects+2 Core Electives+2 Labs)

S.No.	Subject Code	SUBJECT	L	T/P/D	C	Max. Marks	
						Int	Ext
1	R15A2119	Computational Aerodynamics	5	1	4	25	75
2	R15A2120	Airframe Structural Design	4	-	3	25	75
3	R15A0368	Mechanical Vibrations & Structural Dynamics	5	1	4	25	75
4	R15A2121	Avionics	4	-	3	25	75
5		Core Elective - III	4	-	3	25	75
	R15A2122	Aircraft Noise and Aeroacoustics					
	R15A2123	Flight Scheduling Operations					
	R15A0331	CAD/CAM					
6		Core Elective - IV	4	-	3	25	75
	R15A2124	Civil Aviation Rules and Regulations					
	R15A2125	Aircraft Maintenance Engineering					
	R15A2126	Hypersonic Aerodynamics					
7	R15A2186	Computational Aerodynamics Lab	-	3	2	25	50
8	R15A2187	Computational Structures Lab	-	3	2	25	50
TOTAL			**26**	**8**	**24**	**200**	**550**

IV Year B. Tech (AE) – II Semester (2 Core Electives)

S.No.	Subject Code	SUBJECT	L	T/P/D	C	Max. Marks	
						Int	Ext
1		Core Elective - V	5	1	4	25	75
	R15A2127	Helicopter Engineering					
	R15A2128	Advanced Computational Aerodynamics					
	R15A0323	Heat Transfer					
2		Core Elective – VI	5	1	4	25	75
	R15A2129	Aeroelasticity					
	R15A0370	Fatigue and Fracture Mechanics					
	R15A2130	Airline and Airport Management					
3	R15A2188	Mini Project	-	-	4	-	100
4	R15A2189	Technical Seminar	-	6	2	50	-
5	R15A2190	Major Project	15	-	10	100	200
Total			**25**	**8**	**24**	**200**	**450**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A2107)INTRODUCTION TO SPACE TECHNOLOGY

Objectives:

- Students acquire knowledge about the present space technology.
- Students can focus on various orbits, re-entry paths, and also understand the future scenario.
- To provide an exposure with attitude requirements and design limitations.

UNIT - I

Fundamentals of Rocket Propulsion: Space Mission-Types based on Space Environment, vehicle selection. Rocket propulsion-Types, Rocket equation, chemical rocket propulsion, solid propellant rocket motor, liquid propellant rocket engine,

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 - II

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

UNIT - III

Fundamentals of Orbit Mechanics, Orbit Maneuvers: Two-body motion-Circular, elliptic, hyperbolic, and parabolic orbits-Basic Orbital Elements-Ground trace In-Plane Orbit changes-Hohmann Transfer-Bielliptical Transfer-Plane Changes - Combined Maneuvers - Propulsion for Maneuvers.

UNIT - IV

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 - V

Space Mission Operations: Supporting Ground Systems 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.

Reference Books:

1. Vincet L. Pisacane, "Fundamentals of Space Systems", Oxford University Press, 2005.
2. "Understanding Space: An Introduction to Astronautics", J.Sellers, McGraw Hill, 2000.
3. "Introduction to Space Flight", Francis J Hale, Prentice-Hall, 1994.
4. "Spacecraft Mission Design", Charies D.Brown, AIAA education Series, 1998.
5. "Elements of Space Technology for aerospace Engineers", Meyer Rudolph X, Academic Press, 1999.

Outcomes:

- Students can correlate with the different orbits and mechanics available.
- Students can obtain knowledge of space mission operations.
- Students can able to design the conceptual requirements.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

	L	T/P/D	C
III Year B. Tech, ANE-I Sem	**5**	**1/-/-**	**4**

(R15A2108) HIGH SPEED AERODYNAMICS

Objectives:

- Study the basic governing equations of compressible flows and its parameters.
- Study the effects of Shock and Expansion waves on aerodynamic characteristics.
- Learn about the experimental methods to study about compressible flows.

Tables: Isentropic, 1D Flow With Heat Addition and Friction, Normal Shock, Oblique Shock.

UNIT-I ONE DIMENSIONAL COMPRESSIBLE FLOWS

Review of Thermodynamics. Definition of Compressibility, Review of Governing equations. Stagnation conditions, Speed of sound, Mach number, flow regimes, shock waves. Alternative forms of Energy equations, Normal shock relations, Hugonoit equation, One dimensional flow with heat addition and one dimensional flow with friction.

UNIT-II OBLIQUE SHOCK AND EXPANSION WAVES

Oblique shock relations. Super sonic flow over a wedge Θ - β - M relations strong and weak shock solutions , Shock polar. Regular reflection from a solid boundary. Pressure deflection diagrams, Intersections of shock wave. Expansion waves. Prandtl – Meyer Expansion. Shock Expansion theory. Detached shock in front of blunt body.

UNIT-III

SUBSONIC COMPRESSIBLE AND SUPERSONIC LINEARISED FLOW OVER AIRFOIL

Introduction - Velocity potential equation –small perturbation equation - Prandtl-Glauert compressibility corrections - Critical Mach number - Drag divergence Mach number - Area rule - Supercritical airfoil. Linearized supersonic pressure coefficient- Improved compressibility correction factors, Application to airfoil. conical flows-physical aspects, Delta Wing Aerodynamics.

UNIT- IV

FLOW THROUGH NOZZLES AND VARIABLE AREA DUCTS

Area-velocity relation, Isentropic flow through Convergent – Divergent nozzles. Choked flow conditions. Normal shock. Under and Over expansion conditions. Flow through diffusers – wave reflections from a free boundary. Method of Characteristics Application to supersonic wind tunnels and rocket engine.

UNIT-V EXPERIMENTAL AERODYNAMICS

Model testing in wind tunnels and types of wind tunnels. Pressure, Temperature, Velocity measurements – Hotwire and Laser – Doppler anemometer. Force measurements – Wind tunnel balances. Scale effects and corrections, wall interferences, Flow visualization techniques-schileren and shadowgraph methods.

Text Books:

1. Anderson, J .D., Fundamental of Aerodynamics, Mc Graw-Hill International third edition Singapore-2001.
2. Anderson, J .D., Modern Compressible Flow with Historical Perspective, Mc Graw-Hill International third edition Singapore-2004.
3. W.E. Rae & Allen Pope, Low speed wind tunnel testing, John Willey &sons

Reference Books:

1. Radhakrishnan, E, E., Gas Dynamics, Prentice Hall of India, 1995.
2. Hodge B.K & Koenig K Compressible Fluid Dynamics with Computer Application, Prentice Hall, 1995
3. Clancy, L.J., Aerodynamics, Pitman, 1986, Macmillan, 1985

Outcomes:

- Understand the compressible flow parameters effecting flow behavior.
- Able to design nozzle, diffuser and variable area ducts to obtain required aerodynamic outputs.
- Able to understand experimental techniques to find aerodynamic characteristics of different geometries.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem	L	T/P/D	C
	5	1/-/-	4

(R15A2109) AEROSPACE VEHICLE STRUCTURES - II

Objectives:

- To provide the students various methods for analysis of aircraft wings and fuselage.
- To provide the behavior of major aircraft structural components.

UNIT-I

Thin Plate Theory, Structural Instability: 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. Buckling of thin plates-elastic, inelastic, experimental determination of critical load for a flat plate, local instability, Tension field beams-complete diagonal tension, incomplete diagonal tension.

UNIT-II

Bending, Shear and Torsion of Thin Walled Beams: Unsymmetrical bending-resolution of bending moments, direct stress distribution, position of neutral axis. Deflection due to bending and approximation for thin walled sections, temperature effects. Shear loaded thin Walled beams-general stress, strain and displacement relationships, shear centre, twist and warping. Torsion of beams of closed section-displacements associated with Bredt-Batho shear flow. Torsion of open section beams. **St. Venant Torsion Theory of Warping**

UNIT-III

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

UNIT-IV

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-redistributed of bending stresses due to restraining of Warping, limitation of elementary bending theory, effect of accounting for shear lag on the estimated strength.

UNIT-V

Stress Analysis of Aircraft Components- Wing, Fuselage: Wing spars and box beams-tapered wing spar, open and closed section beams. Wings-Three-boom shell in bending, torsion, shear, tapered wings, deflections, cut-outs in wings.

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. M. G., Aircraft Structures for Engineering Students,fourth edn., Elsevier, 2007, ISBN 0-750-667397.
2. Peery, D. J. and Azar,J.J., Aircraft structures, second edn., MCGra-Hill,1982, ISBN 0-07-049196-8.

Reference Books:

1. Allen,D.H. and Haisler,W.E.,introduction to Aerospace structural Analysis,john Wiley,2010.
2. Bruhn.E.H, Analysis and Design of Flight Vechicles structures,Tir-state off-set company,USA,1965.
3. Lakshmi Narasaiah.G, Aircraft Stractures, BS Publications, 2010.
4. Sechler.E.E. and Dunn, L.G., Aiplane Structural Analysis and Design, John Wiley & Sons.

Outcomes:

- Ability to analyse the aircraft wings and fuselage
- Ability to demonstrate the behavior of major aircraft structural components.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem **L T/P/D C**
4 1/ - /- 3

(R15A2110) AIRCRAFT STABILITY AND CONTROL

Objectives:

- To understand the concepts of stability and control of aircraft.
- Develop and understanding of rigid body equations of motion of aerospace vehicle, longitudinal and lateral stability control of aircraft, to know with the aircraft motions and related stability.

UNIT - I:

Aircraft in Equilibrium Flight - Elevator Angle to Trim - Longitudinal Static and Maneuver Stability: Need for controlled flight, Equilibrium, stability, trim, and control- definitions- examples. Longitudinal forces and moments on aircraft in un accelerated flight- contribution of principal components. Equations of equilibrium. Elevator angle required to trim. Longitudinal static stability- definition, Stick fixed neutral point- static margin**. Effect of flaps and flight speed on force and moment coefficients**, aerodynamic derivatives. Steady, symmetric pull-up maneuvers-equations of motion- pitch rate, pitch damping.

UNIT - II:

Estimation of Aerodynamic Force and Moment Derivatives of Aircraft: Derivatives of axial, normal force components and pitching moment with respect to the flight speed, angle of attack, pitch rate, elevator angle, and flight configuration- effects of flaps, power, compressibility and aero elasticity.
Lateral directional motion- coupling- derivatives of side force, rolling and yawing moments with respect to the sideslip, rate of sideslip, roll rate, yaw rate, aileron, and rudder deflections.

UNIT - III:

Stick Free Longitudinal Stability- Control Forces to Trim, Lateral- Directional Static Stability and Trim: Elevator hinge moments- relation to control stick forces. Hinge moment derivatives, Stick force to trim in symmetric un accelerated 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.
Lateral- directional static stability, definition, requirements. 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:

Aircraft Equations of motion- Perturbed Motion- Linearized, Decoupled Equations: Description of motion of flight vehicles- systems of reference frames- Euler angles, angles of attack and sideslip- definitions- earth to body axis transformation, Rotation axis system- expressions for linear and angular momenta of rigid body, time derivatives- inertia tensor, components of linear and angular velocities, accelerations. Description of motion as perturbation over prescribed reference flight condition. Equation of motion in perturbation variables. Assumption of small perturbations, first order approximations- linearized equations of motion. Decoupling into longitudinal and lateral-directional motions- conditions for validity- role of symmetry.

UNIT - V:

Longitudinal and Lateral- Directional Dynamic Stability: Linearized longitudinal equations of motion of aircraft- three degree of freedom analysis- characteristic equations- solutions- principal modes of motion- characteristics- time constant, un damped natural frequency and damping ratio- mode shapes- significance.One degree of freedom, two degree of freedom approximations- constant speed (short period), constant angle of attack (long period) approximations- solutions- comparison with three degree of freedom solutions- justification of approximations. Lateral directional equations- three degree of freedom analysis

Text Books:

1. Yechout, T. R. et al., Introduction to Aircraft Flight Mechanics, AIAA education Series, 2003, ISBN 1-56347-577-4.
2. Airplane performance stability and control by Courtland D.Perkins ,Robert E.Hage John wiley & sons

Reference Books:

1. Etkin, B. and Reid, L. D., Dynamics of Flight, 3rd Edition. 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 Edition., Wiley India, 1995, ISBN 978-]
4. Nelson, R. C., Flight Stability and Automatic Control, 2nd Edition., Tata Mc Graw Hill, 2007, ISBN 0-07-066110-3.

Outcomes:

- An understanding of the static stability of aircraft.
- An understanding of dynamic response of aircraft.
- To assess the requirement of control force and power plant.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

	L	T/P/D	C
III Year B. Tech, ANE-I Sem	**4**	**-/-/-**	**3**

(R15A2111) AEROSPACE MATERIALS AND COMPOSITES (CORE ELECTIVE – I)

Objectives:

- To study the types of mechanical behavior of materials for aircraft applications.
- To make the student understand the analysis of composite laminates under different loading Conditions and different environmental conditions.
- To impart the knowledge in usage of composite materials in aircraft component design.

UNIT-I MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS

Linear and non linear elastic properties – Yielding, strain hardening, fracture, Bauschinger's effect – Notch effect testing and flaw detection of materials and components – creep and fatigue – Comparative study of metals, ceramics, plastics and composites.

UNIT-II HEAT TREATMENT OF METALS AND ALLOYS

Light Metal Alloys: Aluminum and its alloys, high strength and high corrosion alloys. Titanium and its alloys: applications, Classification of steels alloys, effect of alloying elements, magnesium alloys and their properties, maraging steels: properties and applications.

High Strength and Heat Resistant Alloys: Classification of heat resistant materials, iron, nickel and cobalt based alloys, refractory materials, silica based ceramics, properties of inconel, monel, nimonic and super alloys; application of heat resistant alloy in aerospace vehicles. Heat treatment of steel and its alloys. Case hardening, initial residual stresses and stress alleviation procedures, corrosion prevention and protective treatments.

UNIT-III INTRODUCTION T O F COMPOSITE M A T E R I A L S

Introduction, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon-carbon composites, fiber, reinforced composites and nature-made composites and applications.

Reinforcements: Fibers Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide, fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetting

UNIT-IV Hybrid Composites

Basic design concepts of sandwich construction - Materials used for sandwich construction. Failure modes of sandwich panels. Basic design of composite structure, Smart materials, Functionally Graded Materials (FGM)

Selection criteria for Aerospace Materials: Properties of flight vehicle materials, importance of strength/ weight ratio of materials for aerospace vehicles structures, importance of temperature variations, factors affecting the selection of material for different parts of airplanes.

UNIT-V Application and Testing

Classification of Aircraft Materials used for Aircraft Components-Application of Composite Materials-Super Alloys (Ni & Mg Alloys), Indigenes Alloys (Ti6AL4V, Si-Al-Cu). Emerging Trends in Aerospace Materials (Shape memory alloys). Latest techniques in testing and Flaw Detection of Material and Components by mechanical and NDT checks.

Text Books

1. G. F. Titterton, Aircraft Materials and Processes, 5/e, Sterling Book House,1998.
2. D. Agarwal, L.J. Broutman and K. Chandrasekhara, Analysis and Performance of Fibre Composites, Wiley, 3rd edition, 2015
3. Vijay K.Varadan, K.J.Vinoy, S.Gopalakrishnan, Smart Material Systems and MEMS: Design and Development Methodologies,Wiley

References

1. Martin, J.W., "Engineering Materials, Their properties and Applications", Wykedham Publications (London) Ltd., 1987.
2. G. E. Dieter, Mechanical Metallurgy, 1/e, McGraw Hill, 1976.
3. Nonlinear Approaches in Engineering Applications

Outcomes:

- Exposure to high temperature materials for space applications
- Understanding the mechanics of composite materials
- Knowledge gained in manufacture of composites

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

	L	T/P/D	C
III Year B. Tech, ANE-I Sem	**4**	**-/-/-**	**3**

(R15A0367)EXPERIMENTAL STRESS ANALYSIS
(CORE ELECTIVE – I)

Objectives:

- To bring awareness on experimental method of finding the response of the structure to different types of load.
- How to calibrate of different machines with various techniques.
- NDT applications in experimental stress analysis

UNIT I

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

UNIT II

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

UNIT III

ELECTRICAL RESISTANCE STRAIN GAUGES: Principle of operation and requirements of electrical strain gauges. Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis. Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT IV

PHOTOELASTICITY: Two dimensional photo elasticity, Concept of light – photoelastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photoelastic materials. Introduction to three dimensional photo elasticity.

UNIT V

NON–DESTRUCTIVE TESTING: Fundamentals of NDT. Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph, Fiber – optic Sensors. 161.

Text Books:

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

Reference Books:

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

Outcomes:

- Accurately measures the displacement/deflection with precision.
- Distribution stress on a three point bens specimen.
- Use of MEMS/NEMS and sensors to find temperature and strain accurately.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

	L	T/P/D	C
III Year B. Tech, ANE-I Sem	**4**	**-/-/-**	**3**

(R15A0366)ENGINEERING OPTIMIZATION
(CORE ELECTIVE – I)

Objectives:

- Introduce methods of optimization to engineering students, including linear programming, integer programming, quadratic programming, nonlinear programming, and heuristic methods.
- The goal is to maintain a balance between theory, numerical computation, problem setup for solution by optimization software, and applications to engineering systems.

UNIT – I

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

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 – II

Multivariable unconstrained non-linear optimization problems: **Numerical methods** Direct Search methods: Univariate method, Pattern Search methods: Powell, Hook-Jeeve's, Rosen Brock's search and Simplex methods. Gradient methods: Gradient of a function-Importance- Gradient direction search based methods: Steepest descent/ascent method, Conjugate gradient method and variable metric method.

UNIT – III

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 – IV

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

b) 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 – V

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 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

Outcomes:

- formulation of optimization models and solution methods in optimization
- methods of sensitivity analysis and post processing of results
- applications to a wide range of engineering problems

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A0068) TOTAL QUALITY MANAGEMENT
(OPEN ELECTIVE – III)

Objectives:

- Total Quality Management is a method by which management and employees can become involved in the continuous improvement of the production of goods and services.
- It is a combination of Quality and management tools aimed at increasing business and reducing losses due to wasteful practices.
- The simple objective of TQM is "Do the right things, right the first time, every time."

Unit-I

Principles and Practices-I: Introduction,- Gurus of TQM,- Historic Review, Benefits of TQM-Leadership, characteristics of Quality leaders.-The Deming Philosophy-Quality councils-Strategic Planning- Customer Satisfaction-Customer perception of Quality-service Quality,-Customer Retention- Employee Involvement- Employee survey-Empowerment-Gain sharing-Performance Appraisal.

Unit-II

Principles and Practices-II: Continuous process Improvement,- the Juran trilogy,- The PDCA Cycle-Kaizen- Reengineering. Supplier Partnership- Partnering-Sourcing-Supplier Selection-Supplier rating-Performance Measures-Basic concept-Strategy-Quality cost- Bench marking- reasons for bench marking-Process-Understanding current performance-Pitfalls and criticism of benchmarking.

Unit-III

Tools and Techniques-I: Information Technology-Computers and the quality functions-Information quality Issues-Quality management System-Benefits of ISO registration-ISO 9000 series Standards-Internal Audits. Environmental Management System-ISO 14000 series-Benefits of EMS- Relation to Healthy and safety-Quality Function Deployment-The voice of the Customer- Building a House of Quality-QFD Process.

Unit-IV

Tools and Techniques-II: Quality by Design- Benefits-Communication Model-Failure Mode and Effective Analysis-Failure Rate, FMEA Documentation-The process of FMEA Documentation-Product liability-Proof and Expert Witness. Total Productive Maintenance- promoting the Philosophy and Training-Improvements and needs-Autonomous Work groups.

Unit-V

Management Tools: Management Tools,-Introduction-Forced field Analysis-Tree diagram- Process decision Program Chart-Statistical Process Control-Cause and Effect diagram-Histogram-state of control – Process Capability- Experimental Design-Hypothesis-Orthogonal Design-Two factors and Full factors-Quality Strategy for Indian Industries-Quality Management in India.

Text Books:

- Dale H. Besterfield, Total Quality Management, 4/e, Pearson Education India, 2015.
- P M Charantimath, Total Quality Management, 2/e, Pearson Education India, 2011.

Reference Books:

- John Bank, The essence of Total Quality Management, 2/e, Prentice Hall of India 2001.
- Suganthi, L, Samuel, A Anand, Total Quality Management, PHI
- Dr. K.C. Arora, Total Quality Management, S.K. Kataria & Sons, 2010.
- Singhal, K. R.Singhal, Divya, Implementing ISO 9001:2008 Quality Management System: A Reference Guide, 2/e, PHI
- Sridhara Bhat: Total Quality Management, 1/e, Himalaya, 2011
- **S.D.Bagade,** Total Quality Management, 1/e, Himalaya, 2011

Outcomes:

- Accurately measures the displacement/deflection with precision.
- Distribution stress on a three point bens specimen.
- Use of MEMS/NEMS and sensors to find temperature and strain accurately.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A0365) MECHANISMS AND MECHANICAL DESIGN (OPEN ELECTIVE-III)

Objectives:

- The subject gives in depth knowledge on general mechanisms and mechanical design of which aircraft systems are important component.

UNIT – I

Mechanisms: Elements of links: Classification, Types of kinematic pairs: Lower and higher pairs, closed and open pairs. Constrained motion. Kinematic chain, inversions of mechanisms: inversion of quadratic cycle. Chain – single and double slider crank chains.

UNIT – II

Kinematic Analysis and Design of Mechanisms:

Kinematic analysis: 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, Klein's construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

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.

Kinematic Design: Four bar mechanism, Freudenstein equation. Precession point synthesis, Chebyshev`s method, structural error.

UNIT – III

Gyroscope – Processional Motion: 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 – IV

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 – V

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.

Text Books:

1.
2. The Theory of machines – Thomas Beven., Third Edition – Pearson Publishers.
3. Theory of machines and Mechaisms Third Edition – John J. Uicker, Jr. Gordon R. Pennock, Josph E. Shigley, Oxford Publisher.

Reference Books:

1. Mechanism and Machine Theory – J. S Rao, R.V.D Dukkipati, New age Publishers.
2. Theory of Machines, - III rd Edition Sadhu Singh, Pearson Publishers.

Outcomes:

- Application of principles in the formation of mechanisms and their kinematics.
- Able to understand the effect of friction in different machine elements.
- Can analyze the forces and toques acting on simple mechanical systems

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A0521)WEB TECHNOLOGIES
(OPEN ELECTIVE – III)

Objectives:

- Giving the students the insights of the Internet programming and how to design and implement complete applications over the web.
- It covers the notions of Web servers and Web Application Servers, Design Methodologies with concentration on Object-Oriented concepts, Client-Side
- Programming, Server-Side Programming, Active Server Pages, Database Connectivity to web applications, Adding Dynamic content to web applications,
- Programming Common Gateway Interfaces, Programming the User Interface for the web applications.

UNIT I:

Web Basics and Overview: Introduction to Internet, World wide web, Web Browsers, URL, MIME, HTTP, Web Programmers Tool box.

HTML Common tags: List, Tables, images, forms, Frames; Cascading Style sheets. Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script.

UNIT II:

Introduction to XML: Document type definition, XML Schemas, Document Object model, Presenting XML ,Introduction to XHTML, Using XML Processors: DOM and SAX.

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB‘s.

UNIT III:

Web Servers and Servlets: Tomcat web server, Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat, Introduction to Servlets: Lifecycle of a Servlet, JSDK, The Servlet API, The javax. Servlet Package, Reading Servlet 150 parameters, Reading Initialization parameters. The javax.servlet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

UNIT IV:

Database Access: Database Programming using JDBC, JDBC drivers, Studying Javax.sql.* package, Accessing a Database from a Servlet. Introduction to JSP: The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment.

UNIT V:

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing : Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations, Accessing a Database from a JSP page, Deploying JAVA Beans in a JSP Page, Introduction to struts framework.

Text Books:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech (UNIT s 1, 2)
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson (UNITs 3,4,5)

Reference Books:

1. Programming world wide web-Sebesta,Pearson Education ,2007.
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson
3. Internet and World Wide Web – How to program by Dietel and Nieto PHI/Pearson Education Asia.
4. Jakarta Struts Cookbook, Bill Siggelkow, S P D O'Reilly for chap 8.
5. March's beginning JAVA JDK 5, Murach, SPD
6. An Introduction to Web Design and Programming –Wang-Thomson

Outcomes:

- Analyze a web page and identify its elements and attributes.
- Create web pages using XHTML and Cascading Styles sheets.
- Installation and usage of Server software's.
- Database Connectivity to web applications
- Build web applications using Servlet and JSP

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem	L	T/P/D	C
	0	-/3/-	2

(R15A2182)AERODYNAMICS AND PROPULSION LAB

Objectives:

- To know the experimental procedure to find aerodynamic characteristics and functioning of wind tunnel components .
- To familiarize students and to expose them practically to various aircraft piston and gas turbine Engines.

AERODYNAMICS

1. Calibration of Wind Tunnel.
2. Pressure Distribution over an symmetric Airfoil
3. Pressure Distribution on a cylinder
4. Pressure Distribution over a sphere
5. Estimation of aerodynamics characteristics of NACA0012 airfoil
6. Flow visualization on symmetric airfoil
7. Efficiency of Vanes in Centrifugal blower

PROPULSION

8. Performance estimation for single cylinder four stroke Petrol engines.
9. Performance estimation and heat balance test for single cylinder four stroke Diesel engines.
10. Determination of Port timing and sketching for two stroke petrol engine.
11. Determination of Valve timing and sketching for four stroke diesel engine.
12. Estimating the efficiency of centrifugal compressor.
13. Estimating the properties of fuel.
14. Estimating the efficiency of axial flow compressor.

Note: Any 10 Experiments can be conducted minimum 5 from each section

Equipment needed:

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

Reference Books:

1. Low speed wind tunnel testing, W.E. Rae & Allen Pope, John Willey &sons
2. Fundamentals of Aerodynamics by John D Anderson TATA MC GRAW HILL
3. Internal Combustion Engines by RK Rajput Laxmi Publications.

Outcomes

- The student can analyze aerodynamic performance various geometries.
- Ability to understand details of piston and gas turbine engine
- Ability to characterize various aircraft fuels

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

	L	T/P/D	C
III Year B. Tech, ANE-I Sem	**0**	**-/3/-**	**2**

(R15A2183) AEROSPACE STRUCTURES LAB

Objectives:

- To study the properties of materials used in Aircraft structure.
- To study the failure of different component under different loading condition

LIST OF EXPERIMENTS:-

1. Tensile testing using universal Testing Machine - Stress - strain curves and strength tests for various engineering materials.
2. Bending tests - Stress and deflection of beams for various end conditions
3. Verification of Maxwell's and Castigliano's theorems - Influence coefficients.
4. Compression tests on long columns - Critical buckling loads
5. Compression tests on short columns - Critical buckling loads
6. Test on riveted joints.
7. Test on bolted joints.
8. Test using NDT inspection method.
9. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude.
11. Shear Center of open and closed sections.
12. To calculate shear force of a Wagner beam
13. Deflection of a simply supported beam with varying load conditions.

Note: Any10 Experiments should be conducted

Equipment needed

1. UTM – 20 / 40 Tons with. Jigs and Fixtures
2. Deflection test rig (Fabricated hardware + precession dial gauge)
3. NDT Equipment. a) Ultrasonic apparatus, b) Magnetic Particle test rig, c) Dye penetration test.
4. Various Hardware rigs desired in the lab for specific test.
5. Photo and magnetic speed setup
6. Vibration beam setup
7. Shear Center of open and closed section setup.

Reference Books:

1. Megson, T.M.G., Aircraft Structures for Engineering Students, Edward Arnold, 1985.
2. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965

Outcomes:

- Ability to perform non-destructive testing to predict the properties of metabolic materials used in aircraft application

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
5	1/-/-	4

(R15A2112) FINITE ELEMENT ANALYSIS

Objectives:

- It covers the fundamental theoretical approach beginning with a review of differential equations, boundary conditions, integral forms, interpolation, parametric geometry, numerical integration, and matrix algebra.
- Next, engineering applications to field analysis, stress analysis and vibrations are introduced. Time dependent problems are also treated.
- Students are also introduced, by means of selected tutorials, to the commercial finite element system SolidWorks which is similar to one they could be expected to use upon graduation. Graduate students will also be introduced to the more powerful (and difficult to use) Ansys system.

UNIT – I

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Strain – Displacement relations. Stress – strain relations. One Dimensional problems : Finite element modeling coordinates and shape functions. Potential Energy approach : Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT – II

Analysis of Beams : Element stiffness matrix for two node, two degrees of freedom per node beam element. Finite element modelling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.

UNIT – III

Finite element modelling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements. Two dimensional four noded isoparametric elements and numerical integration.

UNIT – IV

Steady state heat transfer analysis : one dimensional analysis of a fin and two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

UNIT-V

Dynamic Analysis : Formulation of finite element model, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Text Books:

1. Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu /Prentice – Hall.
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.

Reference Books:

1. An introduction to Finite Element Method / JN Reddy / Me Graw Hill
2. Finite Element Methods/ Alavala/TMH
3. Finite Element Analysis/ C.S.Krishna Murthy

Outcomes:

- Upon completion of the course students should be able to correlate a differential equation and its equivalent integral form.
- Understand parametric interpolation and parametric geometry enforce essential boundary conditions to a matrix system.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE- II Sem

L	T/P/D	C
5	1/-/-	4

(R15A2113) CONTROL THEORY FOR AIRCRAFT

Objectives:

- To acquire the student with method of modeling,
- Performance analysis of control system and
- Application to aircraft control system.

UNIT I: Control System modeling and feedback control:
Basic components of control system, open loop system, closed loop system, effect of feed back on overall gain, stability, sensitivity & on noise, Linear Vs Non linear system, Time-invariant Vs time varying systems. Modeling of dynamical system by differential equations. Linearization of non-linear system. System type, steady state error, error constant. Composition, reduction of block diagrams of complex systems-rules and conventions. Control system components- sensors, transducers, servomotors, actuators, filters, modeling, transfer function.

UNIT-II: **Time Domain & Frequency Domain Analysis.**
Control system performance, time domain description, output response to control inputs. Characteristic parameters-relation to system parameters. Review of Laplace transform , applications to differential equations, Poles and zeroes, partial fraction decomposition of transfer function. Frequency domain analysis, specification: resonant peak, resonant frequency and band width. Bode Plot, Polar plot. Experimental determination of transfer function by frequency response measurement.

UNIT-III: Design of Control System.
Control system performance requirements, transient and steady state specification. Example of first and second order system. Method of determining stability- Routh-Hurwitz Criterion. Design of controllers: active, passive, series, feed forward, feed back controller. Proportional, integral. Proportional plus derivative control. Lead, lag, lead-lag, wash-out, notch filters: properties and transfer functions. Gain scheduling, Adaptive control-definition, merits. Stability of closed loop system, Root Locus method of analysis and compensation. Nyquist Criterion, gain margin and phase margin.

UNIT-IV : Aircraft response to control- Flying Qualities, Stability and Control Augmentation, Auto pilots.
Approximation to aircraft transfer functions, Flying qualities of aircraft, relation to airframe transfer function. Pilot opinion rating. Stability Augmentation system- displacement & rate feed back, Full authority fly-by-wire control, need for automatic control. Auto pilots- purpose, functioning, displacement auto pilot, pitch, yaw, bank, altitude and velocity hold auto pilot. Auto pilot design by displacement feedback & series PID Controller- Zeigler and Nichols method.

UNIT-V: Modern Control Theory

Limitations of classical control system modeling, multi input multi output systems. State space modeling of dynamical systems, state variable-definition-stateequations. The output variable-the output equation. Representation by vector matrix first order differential equations. Matrix transfer function, state transition matrix- matrix exponential ,properties, Numerical solutions of state equations, examples. Canonical transformation of state equations, Eigen values, real distinct, repeated. Controllability and observability- definition-significance. Digital control system: over view-advantages, disadvantages.

Text Books:

1. KUO, BC. Automatic Control systems, prentice hall India, 1992 ISBN 0-87692-B3-0
2. Nelson R.C. Flight Stability and Automatic control, second edition, tata McGraw-hill2007 ISBN 0-07-666110-3
3. Yechout, T.R , Introduction to flight Mechanics, AIAA,2003,ISBN 1-56347-577-4

Reference Book: Mc Lean, D. Automatic flight Control Systems, prentice hall, 1990

Outcomes:

- The student should be able to model a control system.
- He should be able to estimate the performance of a specified control system including aircraft flight control system.
- He will have good understanding of modern control design methods.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
4	-/-/-	3

(R15A2114) FLIGHT VEHICLE DESIGN

Objectives:

- Students can acquire knowledge of designing a model of aircraft
- Sizing of different components of aircraft can be done
- Performance of different flights can be estimated

UNIT I

DESIGN PROCESS OVERVIEW AIRFOIL AND GEOMETRY SELECTION,THRUST TO WEIGHT RATIO,WING LOADING

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. empty weight estimation –historical trends, fuel fraction estimation, mission profiles, mission segment weight fractions. Airfoil selection, airfoil design, design lift coefficient, stall, airfoil thickness ratio 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

UNIT II

INITIAL SIZING & CONFIGURATION LAYOUT

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 detect ability, aural signature.

UNIT III

CREW STATION, PASSENGERS &PAYLOAD, LANDING GEAR &SUBSYSTEMS
AERODYNAMIC &PROPULSION, STRUCTURES &WEIGHT & BALANCE

Fuselage design- crew station, passenger compartment, cargo provisions, weapons carriage, gun installation 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, aircraft loads, Flight loads- atmospheric, maneuver- construction of flight envelope. Wing loads, Empennage loads, Fuselage loads. Propulsion system selection, jet engine integration, engine dimensions, Nozzle integration, Aircraft materials, design data- allowable, allowable bases. Failure theory.

UNIT IV

PERFORMANCE AND CONSTRAINT ANALYSIS REFINED SIZING & TRADE STUDIES

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.
Elements of life cycle cost, cost estimating method, RDT&E and production costs, operation and maintenance costs, fuel and oil costs, crew salaries Refined conceptual sizing methods. Sizing matrix plot and carpet plot. Trade studies - design trades, requirement trades, growth sensitivities.

Multivariable design optimization methods. Measures of merit Determination of final baseline design configuration, preparation of type specification report

UNIT V

EVOLUTION OF DESIGN

Design of the DC – 1, DC – 2, DC- 3 aircraft, Boeing B-47 and 707, General Dynamics F-16, SR-71 Black bird 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.

Outcomes:

- Students can estimate all the design parameters of an aircraft.
- Ability to model the aircraft structural components
- Ideology of load estimations basing on the formulae can be performed by students

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

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
4	-/-/-	3

(R15A2115) AIRCRAFT SYSTEMS

Objectives:

- To impart knowledge of the hydraulic and pneumatic systems components and types of instruments and its operation to the students

UNIT - I

HYDRAULIC & PNEUMATIC AND LANDING GEAR SYSTEMS

Study of typical workable system – Components – Hydraulic system controllers –Modes of operation Pneumatic systems – Advantages – Working principles – Typical air pressure system – Brake system – Typical pneumatic power system – Components Landing gear systems – Classification – Shock absorbers – Retractive mechanism.

UNIT – II

AIRPLANE CONTROL & MODERN CONTROL SYSTEMS

Conventional systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system, Flexible push full rod system – Components. Digital fly by wire systems – Auto pilot system active control technology,

UNIT - III

ENGINE CONTROL & FUEL SYSTEMS.

Fuel system for piston and jet engines - Components of multi engines – Lubricating systems for piston and jet engines. Starting and Ignition systems – Typical examples for piston and jet engines. Full authority control systems. Engine monitoring-sensors, indicators.

UNIT - IV

AIR CONDITIONING AND PRESSURIZING SYSTEMS

Basic air cycle systems – Vapor cycle systems, Boost – strap air cycle system – Evaporative vapor cycle systems – Evaporative air cycle systems – Oxygen systems – Fire protection systems, De-icing and anti-icing systems.

UNIT - V

ELECTRICAL SYSTEMS

Electrical loads in aircraft. Electrical power generation and control of AC and DC. Bus bars, power distribution of different voltages AC & DC. over/under load protection devices-speed and frequency protection devices. Electrical load measurement systems.

Text Books:

1. McKinley, J.L., and Bent, R.D., Aircraft Maintenance & Repair, McGraw Hill, 1993.
2. Transportation, Federal Aviation Administration The English Book Store, New Delhi, 1995
3. Moir, I and Seabridge, A., Aircraft Systems: Mechanical,Electrical and Avionics Subsystems Integration, 3rd edn, John Wiley,2008, ISBN 978-0-470-05996-8.

Reference Books:

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

Outcomes:

- The student should able to Know the operation of airplane control system, Engine system, Air conditioning and pressing system.
- Know the operation of air data Instruments system

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A2116) LAUNCH VEHICLE AND MISSILE TECHNOLOGY (CORE ELECTIVE – II)

Objectives:

- Students acquire knowledge about the present space equipment.
- Students can focus on various launch systems available in aerospace industry and also understand the future scenario.
- To provide an exposure with testing and design limitations**.**

UNIT-I

LAUNCH VEHICLE: Role and military functions of space launch vehicle, Types, missions, mission profile, Thrust profile, propulsion system, and staging employed in the vehicle, guidance and control requirements, and performance measurements. Design process employed in launch vehicle, construction procedure, some successful launch vehicles, Description of a typical space launch vehicle procedure, Description of space shuttle engine, Propellant slosh - Propellant hammer, Geysering effect in cryogenic rocket engines

UNIT-II

MISSILES: Types of Missiles, simililarities and differences with launch vehicle, types controls for 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 moments, Lateral damping moment and longitudinal moment of a rocket-Lift and drag forces, Drag estimation- Body upwash and downwash in missiles-Rocket dispersion.

UNIT-III

VEHICLE DYNAMICS: Tsiolskovsky's rocket equation- range, gravitational field, inclined motion, flight path at constant pitch angle. Multi staging, Earth launch trajectories-vertical segment, gravity turn, constant pitch trajectory. Actual launch vehicle trajectory, types. Examples, Reusable launch vehicles, Rocket thrust vector control - Methods of thrust vector control-Thrust magnitude control, Thrust Termination, Stage separation dynamics-Separation techniques.

UNIT-IV

PROPULSION: Solid propellant rocket motors, principal, applications, Solid propellant types, composition, properties, performance, Propellant grain, properties, configuration, prepartion, loading, structural design, Liners, insulators and inhibitors- functions, requirements, materials, Rocket motor casing- materials. Nozzle, types, design, construction, thermal protection, Igniters, types, construction, Description of modern solid boosters, Liquid propellants-types, composition, properties, performance, Propellant tanks, feed systems- pressurisation, turbo-pumps-valves and feed lines, injectors, starting and ignition, Engine cooling, system calibration, safety and environment concerns.

UNIT V

TESTING: Ground testing and flight testing- types, safe guards, control of toxic materials instrumentation and data management, Procedures- ground testing, flight, trajectory, post accident, Criteria for Selection of materials for rockets and missiles- requirements, Choice of materials at cryogenic temperatures, extremely high temperatures, Requirement of materials for thermal protection and 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.

Outcomes:

- Students can correlate with the different launch vehicles and missiles available.
- Students will be able to configure the launch vehicle or missile required for specific purpose.
- Students can able to design the conceptual requirements.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
4	-/-/-	3

(R15A2117) AIR TRANSPORTATION SYSTEMS
(CORE ELECTIVE – II)

Objectives:

- The subject will introduce the air transportation systems in detail.
- To study the basic governing bodies of ATS, its laws and regulations
- To understand the Airspace sectors, setting up Airport, Airlines and economic considerations involved in it

UNIT-I

Aviation industry & its regulatory authorities: Introduction, history of aviation-evolution, development, growth, challenges. Aerospace industry, air transportation industry-economic impact-types and causes. Airline Industry-structure and economic characteristics.The breadth of regulation-ICAO, IATA, national authorities (DGCA, FAA).Safety regulations-risk assessment-human factors and safety, security regulations, environmental regulations.

UNIT-II

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 system service provides as businesses.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.

UNIT-III

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

UNIT-IV

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

UNIT-V

Airlines: Setting up an airline-modern airline objectives. Route selection and development, 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.Airlinescheduling, Evaluating success-financial viability, regularity compliance, efficient use of resources, effective service.

Text Books:

1. Hirst, M., The Air Transport System,Wood head Publishing Ltd,Cambridge, England, 2008.

Reference Books:

1. Wensven, J.G.,AirTransportion:A Management Perspective, Ashgate, 2007.
2. Belobaba,P.,Odoni,A.andBarnhart,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,fourthedn., Thomson Learning, 2004.
5. Wells, A. and young, S.,Airport Planning and Management, fifth edn., McGraw-Hill, 1986.

Outcomes:

- The operational structure of the Airport, its establishing, working strategies in detail
- The economic and the business outcomes of the operations of ATS
- The student with acquire operational knowledge of air transport system

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
4	-/-/-	3

(R15A2118) SPACE MECHANICS
(CORE ELECTIVE – III)

Objectives:

- Students will able to learn about various orbits, positioning of satellite in an orbit and consequences in flight dispersions.
- Students can focus on various launch systems available in aerospace industry and also understand the future scenario.
- To provide an exposure with testing and design limitations.

UNIT-I

BASIC CONCEPTS

Kepler's Laws of motion, the solar system-Reference frames and coordinate systems-The celestial sphere- The ecliptic-Motion of vernal equinox-Sidereal time-Solar Time-Standard Time-The earth's atmosphere

UNIT-II

THE GENERAL N-BODY PROBLEM

The many body problem-Lagrange-Jacobi identity-The circular restricted three- body problem-Libration points-Relative Motion in the N-body problem

UNIT-III

THE TWO-BODY PROBLEM

Equations of motion-General characteristics of motion for different orbits-Relations between position and time for different orbits-Expansions in elliptic motion-Orbital Elements-Relation between orbital elements and position and velocity

UNIT-IV

THE LAUNCHING OF A SATELLITE

Launch vehicle ascent trajectories-General aspects of satellite injection-Dependence of orbital parameters on in-plane injection parameters-Launch vehicle performances- Orbit deviations due to injection errors

PERTURBED SATELLITE ORBITS

Special and general perturbations- Cowell's Method-Encke's method-Method of variations of orbital elements-General perturbations approach

UNIT-V

INTERPLANETARY TRAJECTORIES

Two-dimensional interplanetary trajectories-Fast interplanetary trajectories-Threedimensional interplanetary trajectories-Launch of interplanetary spacecraft-Trajectory about the target planet

BALLISTIC MISSILE TRAJECTORIES

The boost phase-The ballistic phase-Trajectory geometry-Optimal flights-Time of flight-Re-entry phase-The position of the impact point-Influence coefficients.

LOW-THRUST TRAJECTORIES

Equations of Motion-Constant radial thrust acceleration-Constant tangential thrust(Characteristics of the motion, Linearization of the equations of motion- Performance analysis

Text Books:

1. ”Rocket Propulsion and Spaceflight Dynamics”, J.W.Cornelisse, H.F.R. Schoyer, and K.F. Wakker, Pitman, 1979
2. ”Spaceflight Dynamics”, William E.Wiesel, McGraw-Hill, 1997

Reference Books:

1. "Spacecraft Mission Design”, Charles D.Brown, AIAA Education Series, Published by AIAA, 1998
2. “Orbital Mechanics”, Vladimir A. Chobotov, AIAA Education Series, AIAA Education Series, Published by AIAA, 2002
3. ”Fundamentals of Astrodynamics and Applications”, David.A. Vellado, Microcosm and Kluwer, 2001
4. ”Fundamentals of Astrodynamics”, Rodger R. Bate, Donald .D. Muller 1971

Outcomes:

- Students can able to summarize the trajectory requirements for launching a vehicle or missile.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A0371) GREEN ENERGY SYSTEMS (OPEN ELECTIVE-IV)

Objectives: To study important non-conventional energy resources and the technologies for harnessing these. Compare different non-conventional energy resources and choose the most appropriate based on local conditions.

UNIT -I

Introduction, Energy sources and availability, New energy techniques, Renewable energy sources Solar Energy; Solar constant, Radiation geometry, Solar energy collectors, Concentrated and flat plate, Energy balance and collector efficiency, Solar energy storage, Application to space heating, distillation, cooking and green house effect

UNIT -II

Wind Energy; Basic principle, site selection, Aerodynamic analysis of blades, Bio-energy; Biomass conversion technology, photosynthesis, Biogas plant, thermal gassification

UNIT- III

Geothermal Energy; Sources, hydrothermal sources, hot dry rock resources, geothermal fossil system, prime movers for geothermal energy Energy from ocean; Ocean thermal electric conversion, energy from tides, small scale hydroelectric development

UNIT -IV

Hydrogen energy sources; Production, storage, utilization, magneto hydrodynamic power, thermo ionic generation, Nuclear fusion energy, Energy storage. Energy conservation.

UNIT- V

Fuel cell Principle of working, construction and applications

Text Books:

1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2. S Rao, B B Parulekar, Energy Technology: Non Conventional Renewable and Conventional, Khanna Publishers, Delhi.
3. H.P. Garg & Jai Prakash, Solar Energy: Fundamentals and Applications, Tata McGraw Hill, N Delhi.

Reference Books:

1. S P Sukhatme, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, N Delhi.
2. Sutton, Direct Energy Conversion, McGraw Hill Inc., 1966.
3. Duffie and Beckman, Solar Energy Thermal processes, John Wiley, 1974

Outcomes:

- Design renewable/hybrid energy systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
4	-/-/-	3

(R15A0568) APPS DESIGN AND DEVELOPMENT (OPEN ELECTIVE – IV)

Objectives:

- Knowledge of basic software engineering fundamentals and practices.
- Introducing multimedia practices and graphic fundamental.
- Knowledge of basic java programming under client/server side and data base connection.

UNIT – I: Fundamental concepts

Software Process models**:** The waterfall model, Incremental process models, Evolutionary process models, The Unified process. Multimedia and hypermedia, World Wide Web, overview of multimedia software tools, Graphics data types, file formats, color in image and video: color models in images, color in video.

UNIT – II: HTML Common tags

List, Tables, images, forms, Frames; Cascading Style sheets.

UNIT - III: Introduction to Java Scripts

Objects in Java Script, Dynamic HTML with Java Script.

UNIT - IV: Web Servers

Introduction to Servlets: Lifecycle of a Servlet, The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing, Environment: Installing the Java: Software Development Kit, Tomcat Server. Using Cookies-Session Tracking, Security Issues.

UNIT - V: Database Access

Database Programming using JDBC, Studying Javax.sql.* package, Accessing a Database from a JSP Page, TESTING: Types of software testing ,test cases.

Text Books:

1. Web Programming ,Building Internet Applications, CHRIS BATES Ii Edition, Wiley Dreamtech.
2. Programming world wide web ,SEBESTA,PEARSON.

Reference Books:

1. Core Servlets And Java Servlets Pages Vol-1:Core Technologies BY MARTY HALL,LARRY BROWN PEARSON.
2. Software Engineering ,ROGERS PRESSMEN,TATA McGraw-HILL.
3. Software Testing Techniques, BORIS BEIZER,DREAMTECH,II EDITION.
4. Java Complete Reference ,7TH EDITION ,HERBERTSCHILDT,TMH.

Outcomes:

- Ability to identify the minimum requirements for the development of application.
- Ability to apply different multimedia development tools to produce web based and stand-alone user interfaces.
- Gain knowledge of client side scripting, understanding of server side scripting with java.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
4	-/-/-	3

(R15A0062) SUPPLY CHAIN MANAGEMENT (OPEN ELECTIVE – IV)

Objectives:

- To introduce the major building blocks, major functions, major business processes, performance metrics, and major decisions (strategic, tactical, and operational) in supply chain networks.
- To provide an insight into the role of Internet Technologies and technical aspects of key ITEC components in supply chain management.

Unit-I

Understanding the Supply Chain: What is supply chain; objectives and importance of supply chain; decision phases in supply chain; process views of s supply chain; examples of supply chain.

Unit-II

Designing Distribution Networks: The role of distribution in the supply chain; factors influencing distribution network design; design options for distribution network; e-business and the distribution network; distribution channels for FMCG sector, commodities, and agricultural produce; factors influencing network design decisions; models for facility location and capacity allocation.

Unit-III

Demand Forecasting And Aggregate Planning: Methods and Characteristics of demand forecasting; forecasting in practice; the role of aggregate planning in SCM; aggregate planning strategies; aggregate planning using linear programming; the role of IT in aggregate planning; implementing aggregate planning in practice.

Unit-IV

Managing Inventories in Supply chains: Cycle inventory; estimating cycle inventory cost; economies of scale to exploit fixed costs and quantity discounts; short term discounting: trade promotions; safety inventory in supply chain and uncertainties; the role of IT in inventory management; estimating and managing safety inventory in practice. Nature of global supply chain management.

Unit-V

Transportation and Sourcing in SCM: Role of transportation in SCM; transportation infrastructure and policies; design options for transportation network and trade-offs; tailored transportation system; risk management; transportation decisions in practice; Sourcing in SCM: in-house or outsource; third and fourth party logistics; contracts, risk sharing and supply chain performance; vendor analysis; the procurement process. Lack of coordination and the Bullwhip Effect; obstacles to coordination in a supply chain; building strategic partnership and trust within a supply chain.

Text Books:

1. Chopra, S, and P. Meindl, 2010, Supply Chain Management - Strategy, Planning and Operation, 4th Edition, Pearson Education Inc.

Reference Books:

1. Raghuram, G. and N. Rangaraj, Logistics and Supply Chain Management: Cases and Concepts, Macmillan, New Delhi

2. Simchi-Levi, D., P. Kaminski and E. Simchi-Levi, 2003, Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies, 2nd Edition, Irwin, McGraw-Hill.
3. Shapiro, J., 2001, Modelling the Supply Chain, Duxbury Thomson Learning.

Outcomes:

- Student will get awareness how to obtain customer sophistication, increasing network fragmentation, and fast-paced globalisation, the primary role of supply chain management, along with the coordination of material, information and cash flows, has become complex.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
2	-/-/-	0

(R15A0005) TECHNICAL COMMUNICATION AND SOFT SKILLS

(A Mandatory Course)

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 competencies of Engineering students.

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.

Objectives:

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To equip the students to approach academic subjects more professionally using the theoretical and practical components of the English syllabus.
- To develop the professional skills and communication skills in formal and informal situations and hone the required professional ethics.

Unit- 1: Factors affecting information and document design, Principles of effective writing , Technical Writing, Grammar and Editing- Technical writing process, Writing drafts and revising, Collaborative writing, technical writing style and language.

Unit- 2: Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication.

Unit-3: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids. Writing reports, Email writing, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Unit- 4: Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, self esteem.

Unit- 5: Ethics- Business ethics, , Personality Development in social and office settings, netiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Rapid reading, Complex problem solving, Creativity, leadership skills ,cubicle Etiquettes, team building.

Text Books:

1. David F. Beer and David Mc Murrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)

Reference Books:

1. Dale Jung k, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
2. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
3. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

Outcomes:

- The student will become proficient in LSRW skills.
- They develop formal LSRW skills approach to different situations.
- They hone professional ethics and learn to be proficient formally.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

	L	T/P/D	C
(R15A2184) FLIGHT VEHICLE DESIGN AND INSTRUMENTATION LAB	-	-/3/-	2

Objectives:

- This course is an introduction to aircraft design emphasizing on the conceptual design of civil transport and fighter aircraft.
- To impart the basic skills in flight vehicle designing and relevant skills in calculating sizes;

LIST OF EXPERIMENTS:-

The student is expected to conduct 10 exercises

1. Aircraft Conceptual 3D sketching
2. Creating Airfoil and sketching
3. Estimating Wing Loading
4. Initial sizing of an Transport Aircraft
5. Weight Estimation of Fighter Aircraft
6. Design of Crew compartment
7. Wing Design and Drag Estimation
8. Engine Sizing
9. Cost Estimation
10. Horizontal and Vertical Tail Design
11. Operation of Hydraulic Test Rig
12. Operation of Pneumatic Test Rig
13. Demonstration of Landing gear and Control surface retraction systems

Note: Minimum 10 experiments should be conducted.

Software Required: Microsoft Excel or MATLAB Programming or Equivalent software

Reference Books:

1. AIRCRAFT DESIGN: A Conceptual Approach AIAA Book ISBN:0-930403-51-7 by Daniel P Raymer

Outcomes:

- Able to develop detailed design requirements from a general mission statement.
- Able to identify major trade-offs and resolve them using sizing.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ANE-II Sem

L	T/P/D	C
0	-/3/-	2

(R15A2185)PROGRAMMING LANGUAGE FOR MATHEMATICAL MODELS LAB

Objectives:
The course should enable the students to:

- Learn the mathematical programming language.
- Learn the problem solving techniques
- Develop skills in programming language

LIST OF EXPERIMENTS:-

1. Introduction to modeling software.
2. Programs using mathematical functions and plotting functions.
3. Program to solve differential equations.
4. Program to solve system of equations using numerical methods.
5. Program to find critical Mach number of an airfoil and to generate drag polar graph.
6. Program to find flow characteristics across shock waves.
7. Program to calculate the performance of turbofan.
8. Program to find the flow characteristics of a CD nozzle.
9. Program to calculate the deflection, bending moment, shear force in a beam.
10. Determine the buckling load of a column with different end conditions.
11. Find out displacements of a uniform bar/stepped bar subjected to mechanical/thermal loads.
12. Program to generate poles and zeros of a transfer function.
13. Program to generate time response, rise time and maximum overshoot of a second order control system.

Note: Any 10 Experiments can be conducted.

Equipment Needed:

1. **Computers**: Core 2 duo processor with 1 GB RAM
2. **Softwares:** Matlab or scilab or equivalent softwares

Reference Books:

1. MATLAB an Introduction with Applications Fifth Edition AMOS GILAT by WILEY Publications
2. Programming in SCI lab by VINU V DAS NEW AGE INTERNATIONAL PUBLICATIONS
3. Fundamentals of Aerodynamics by John D Anderson
4. Strength of materials by Ramarutham Dhanpath Rai publications

Outcomes:
The student should be able to

- Model aerospace problems into mathematical models.
- Revise computational strategies for developing applications.
  Develop applications (Simple to Complex) using programming language.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
5	1/-/-	4

(R15A2119)COMPUTATIONAL AERODYNAMICS

Objectives:

- Application of CFD to various engineering problems.
- Understand the physics of mathematical equations governing aerodynamic flows.
- Numerical methods to solve fluid flow problems

UNIT-I - INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

CFD – Why Computational Fluid Dynamics? What is CFD? CFD - Research tool – Design Tool, Application of CFD to various Engineering problems. Models of fluid flow- Finite Control Volume, Infinitesimal Fluid Element. substantial derivatives, divergence of Velocity.

UNIT-II - GOVERNING EQUATIONS OF FLUID DYNAMICS

The continuity equation, the momentum equation, the energy equation, physical boundary conditions. Form of Governing equation suited for CFD - Conservation form - shock fitting and shock capturing.impact of partial differential eqautions on CFD. Classification of Quasi-Linear Partial differential equation, The Eigen value method, General behavior of different classes of Partial differential equation – elliptic, parabolic and hyperbolic.

UNIT-III – DISCRETIZATION TECHNIQUES

Introduction, Finite differences and formulas for first and second derivatives, difference equations, Explicit and implicit approaches, multidimensional finite difference formulas, finite difference formulas on non-uniform grids. Basis of finite volume method- conditions on the finite volume selections- approaches - Cell-centered and cell-vertex Definition of finite volume discretization general formulation of a numerical scheme- Two dimensional finite volume method with example.

UNIT-IV - GRID GENERATION

Need for grid generation. Structured grids- Cartesian grids, stretched (compressed) grids, body fitted structured grids, Multi-block grids - overset grids with applications.

Unstructured grids- triangular/ tetrahedral cells, hybrid grids, quadrilateral/hexahedra cells. Grid Generation techniques - Delaunay triangulation, Advance font method. Surface and volume estimations, grid quality and best practice guidelines.

UNIT-V – CFD TECHNIQUES

Lax-Wendroff technique, MacCormack's technique, Crank Nicholson technique, Relaxation technique- aspects of numerical dissipation and dispersion, Alternating-Direction-Implicit (ADI) Technique. Pressure correction technique Numerical procedures- SIMPLE, SIMPLER algorithms SIMPLEC and PISO algorithms Boundary conditions for the pressure correction method. Parallel Computing.

Text Books:

2. John .D. Anderson “Computational Fluid Dynamics”, McGraw Hill
3. Charles Hirsch “Numerical computation of internal and external flows” Second Edition Butterworth-Heinemann is an imprint of Elsevier

Reference Books:

1. Hoffmann, K.A: Computational Fluid Dynamics for Engineers, Engineering Education System, Austin, Tex., 1989
2. J Blazek “Computational Fluid Dynamics: Principles and Applications” Elsevier.
4. Introduction to Computational Fluid Dynamics, Chow CY, John Wiley, 1979

Outcomes:

- Solve differential equations governing fluid flow problems.
- Generation of grid according to geometry of flow.
- Application of CFD techniques for aerospace problems.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A2120) AIRFRAME STRUCTURAL DESIGN

Objectives:

- To know about detailed structural components present in aircraft
- To acquire the knowledge about the design parameters how why and where they will be used in manufacturing
- Students can acquire the knowledge about the loading conditions done on the structure

UNIT I

INTRODUCTION

Principal structural components of aircraft. Design requirements- structural integrity, stiffness, service life. Baseline aerodynamic configuration, external loading, weight, operating conditions, conformity to government regulations. Design procedure- structural lay out, structural modeling, design criteria, load estimation, stress analysis, choice of materials, sizing- estimation of strength, stiffness, mass . optimization, trade-off. Structural index- use in design. Idealization of structures, materials- constitutive relations- equilibrium, compatibility conditions significance. 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.

Unit II

FASTENERS AND STRUCTURAL JOINTS

Fasteners and fittings- role , significance, general design considerations, criteria for allowable strength. Margine of safety. Fastener systems, types, fastener information, dimensions, materials, allowable strength- tensile, shear, bending. Rivets, bolts and screws, nuts-detail design consideration. Fastener selection. fittings- lugs, bushings and bearings-loading design and analysis. Joints – splices, 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 III

DESIGN OF WING AND TAIL 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- loads, stress .Wing box,root bulkhead-estimation of loads, stress analysis, design parameters, optimization, sizing, margin of safety.. Leading and trailing edge assembly- control surfaces, flaps- structure. Tail unit- horizontal, vertical tail, elevator, rudder-configuration, structural layout, design considerations.

UNIT IV

DESIGN OF FUSELAGE AND LANDING GEAR

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

UNIT V

FATIGUE LIFE, DAMAGE TOLERANCE, FAIL SAFE- 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- significanceFail-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, 1987, ISBN: 962-7128-08-2

Out comes:

- Students will be acquainted with design criteria of aircraft component
- Students will be acquainted with manufacturing procedure from the design criteria
- Students will easily design their own components based on the design criteria they have learned

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
5	1/-/-	4

(R15A0368) MECHANICAL VIBRATIONS AND STRUCTURAL DYNAMICS

Objectives:

- To gain fundamental knowledge on vibration and related systems in the context of Aircraft Structures
- To give Exposure on damped and undamped vibratory systems.
- Basic knowledge on dynamic balancing of rotor system

UNIT-I

FUNDAMENTALS OF VIBRATION: Brief history of vibration, Importance of the study of vibration, basic concepts of vibration, classification of vibrations, vibration analysis procedure, spring elements, mass or inertia elements, damping elements, harmonic analysis. FREE VIBRATION OF SINGLE DEGREE OF FREEDOM SYSTEMS: Introduction, Free vibration of an undamped translational system, free vibration of an undamped torsional system, stability conditions, Raleigh's energy method, free vibration with viscous damping, free vibration with coulomb damping, free vibration with hysteretic damping.

UNIT-II

HARMONICALLY EXITED VIBRATIONS: Introduction, Equation of motion, response of an undamped system under harmonic force, Response of a damped system under harmonic force, Response of a damped system under harmonic motion of the base, Response of a damped system under rotating unbalance, forced vibration with coulomb damping, forced vibration with hysteresis damping.

UNIT-III

VIBRATION UNDER GENERAL FORCING CONDITIONS: Introduction, Response under a general periodic force, Response under a periodic force of irregular form, Response under a non periodic force, convolution integral. Two Degree of Freedom Systems: Introduction, Equation of motion for forced vibration, free vibration analysis of an undamped system, Torsional system, Coordinate coupling and principal coordinates, forced vibration analysis.

UNIT-IV

MULTIDEGREE OF FREEDOM SYSTEMS: Introduction, Modeling of Continuous systems as multi degree of freedom systems, Using Newtons second law to derive equations of motion, Influence coefficients, Free and Forced vibration of undamped systems, Forced vibration of viscously damped systems. Determination Of Natural Frequencies and Mode Shapes: Introduction, Dunkerleys formula, Rayleighs method, Holzers method, Matrix iteration method, Jacobi;s method.

UNIT-V

CONTINUOUS SYSTEMS: Transverse vibration of a spring or a cable, longitudinal vibration of bar or rod, Torsional vibration of a bar or rod, Lateral vibration of beams, critical speed of rotors.

Text Books:

1. Mechanical Vibrations by S.S.Rao.
2. Mechanical Vibrations by V.P.Singh

Reference Books:

1. Mechanical Vibrations by G.K. Grover
2. Mechanical Vibrations by W.T. Thomson
3. Mechanical vibrations: theory and application to structural dynamics, Michel Géradin, Daniel Rixen, John Wiley, 1997

Outcomes:

- Fundamental frequency of Multi- DOF systems can estimate by various methods.
- Effect of unbalance in rotating masses has been studied.
- How to determine eigenvalues and eigenvectors for a vibratory system has analysed

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A2121) AVIONICS

Objectives:

To introduce the student the

- Avionics System
- Instruments system installed on aircraft.
- Aircraft Control System e.g. Auto-Pilot

UNIT I: Introduction to Avionics

Importance and role of Avionics in modern aircraft-systems which interface directly with pilot-aircraft state sensor systems, outside world sensor systems, task automation systems. The avionics equipment and system requirement- environmental, weight, reliability. Standardization and specification of avionics equipment and systems- ARINC and MIL specification. Electrical and optical data bus systems. Integrated modular avionics architectures.

UNIT II: Display , man-machine interaction and communication system:

Introduction to displays-head-up displays(HUD)-basic principles, Helmet mounted displays,head taracking systems. Head down displays-civil cockpit, military cockpit, solid state standby display systems, data fusion in displays-intelligent display systems. Introduction to voice and data communication systems- HF,VHF,UHF and satellite communications, data recorders

UNIT III: Inertial sensors and Global Positioning System.

Basic principles of gyroscope and accelerometers. Introduction to optical gyroscope- ring laser gyros-principles. Stable platform system-strap down systems- error in inertial systems and components.
Global navigation satellite systems-GPS-description and basic principles. Integration of GPS and INS, Differential GPS, Future Augmented Satellite navigation systems.

UNIT IV: Air Data Systems, Navigation and Landing System

Air data Information and its use, derivation of Air Data Laws and relationship- altitude-static pressure relationship, variation of ground pressure, speed of sound, mach Number, CAS, TAS, Pressure error. Air data sensors and computing. Principles of Navigation- types of navigation systems- radio navigation systems- VHF omni-range, distance measuring equipment, automatic direction finders. Inertial navigation System-Initial alignment and gyro compassing, strap down INS computing. Landing System- localizer and glide-slope-marker systems. Categories of ILS.

UNIT V: Surveillance and Auto flight Systems:

Traffic alert and collision avoidance systems(TCAS)-Enhanced ground proximity warning system, Mode S Transponder, Weather radar system. Autopilots-Basic principle, height control, heading control, ILS coupled autopilot control, satellite landing system, speed control and auto throttle

systems. Flight management systems-principles-flight planning-navigation and Guidance, performance prediction and flight path optimization.

Text Books:

1. Collinsion, R.P.G., Introduction to Avionics Systems, second edition, Springer,2003,ISBN 978-81-8489-795-1
2. Moir, I. and Seabridge,A., Civil Avionics Systems, AIAA education Series, AIAA, 2002, ISBN 1-56347589-8

Reference Books:

1. Kayton, M., & Fried, W.R>, Avionics Navigation Systems, Wiley, 1997,ISBN 0-471-54795-6Z

Outcomes:

- The student would gain understanding of the basic principles of avionics system
- Application of Avionics System in operation of aircraft.
- Student will have good understanding of various sensors on aircraft.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A2122) AIRCRAFT NOISE AND AEROACOUSTICS
(CORE ELECTIVE - III)

Objectives:

- To provide students in-depth knowledge of the noise generation mechanisms of aircraft noise and its environmental issues.
- Analysis using aeroacoustic theory will be introduced.

UNIT – I

Noise Radiation from Aircraft: Aircraft noise descriptors. Human response to aircraft noise. Actions against aircraft noise. Noise certification and regulation. Atmospheric Propagation: Introduction, Geometrical Spreading, Effects Due to the Presence of the Ground, Refraction by Vertical Gradients of Wind and Temperature, Atmospheric Turbulence, Diffraction Large-Amplitude Waves, Pulses, and Sonic Booms

UNIT - II

Introduction to Aeroacoustic Theory: Equation of linear acoustics. Free-space Green's function. Acoustics of point sources. Lighthill's acoustic analogy and its extensions. Acoustics of turbulence near a rigid body. Radiation from compact and non-compact sources. Fuselage dynamics and cabin noise.

UNIT - III

Noise Source Mechanisms: Airframe noise. Propeller noise Characteristics, Generating Mechanisms, Prediction Methods for Propeller Harmonic Noise and Broadband Noise, Propagation Effects. Fan and compressor noise. Turbine noise. Jet noise. Combustor noise. Sonic boom. Helicopter noise. Interior noise.

UNIT - IV

Noise Control: Noise control at sources. Jet Noise Suppression Concepts, Jet Noise Reduction Techniques, Control of Propeller Noise, Sonic Boom Minimization, Cabin noise control. Interior Noise Control Application.

UNIT – V

Quiet Aircraft Design and Operational Characteristics

Scope Airplane Noise Level Design Requirements and Objectives, Major Design Considerations, Major Operational Considerations, The Design and Development Process, Noise Engineering of Other Flight Vehicles.

Textbooks:

1. Crighton, D. G., Dowling, A. P., Ffowcs Williams, J. E., Heckl, M., Leppington, F. G., Modern Methods in Analytical Acoustics – Lecture Notes, Springer, latest edition.
2. Goldstein, M. E., Aeroacoustics, McGraw-Hill, latest edition.
3. Howe, M. S., Theory of Vortex Sound, Cambridge University Press, latest edition.
4. Hubbard, H. H. (Ed.), Aeroacoustics of Flight Vehicles – Theory and Practice, Vols. 1 & 2, Acoustical Society of America, latest edition.

Outcomes:

Upon completion of the subject, students will be able to:

- possess state-of-the-art knowledge and skills in the area of aircraft noise;
- apply their knowledge, skills and hand-on experience to analyze the noise generation of key aircraft components, its radiation and environmental consequences;
- extend their ability to integrate various noise suppression techniques in achieving quiet design and operation of aircraft

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem	L	T/P/D	C
	4	-/-/-	3

(R15A2123)FLIGHT SCHEDULING AND OPERATIONS
(CORE ELECTIVE – III)

Objectives:

- Students will able to know about the operations of an airline
- Will analyze how the scheduling is done for flights
- Will know about crew duties and passengers boarding procedures

UNIT I

AIRLINE NETWORK AND AIRCRAFT ROUTING

Complexity of airline planning, operations and dispatch- need for optimization- 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. 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 II

FLIGHT AND FLEET 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. 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 III

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. Man power scheduling- modeling, formulation of the problem, solutions.

UNIT IV

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 V

AIRLINE IRREGULAR OPERATION, DISRUPTION OF SCHEDULE AND RECOVERY COMUTATIONAL COMPLEXITY-CASE STUDIES

The problem statement, the time band approximation model formulation of the problem the scenarios- solution.Complexity theory, heuristic procedures Case studies of airline operation and scheduling study through simulation modeling- use of available software.

Text Books:

1. Bazargan,M.,'Airline Operations and Scheduling'2nd edn., Ashgate Publishing ltd, 2010

Outcomes:

- Students can schedule different operations done by airport authorities.
- Students can schedule different operations done by airlines authorities.
- They will be getting a knowledge about the functioning of airports

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A0331) CAD/CAM
(CORE ELECTIVE - III)

Objectives:

The student able to know about the CAD/CAM software, computer graphics, drafting, numerical control, group technology, CIM and computer aided quality controls

UNIT – I

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

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

UNIT – II

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

UNIT – III

Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

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

UNIT – IV

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

UNIT – V

Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-nonoptical, computer aided testing, integration of CAQC with CAD/CAM.

Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

Text Books:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH Publishers
2. CAD / CAM /A Zimmers & P.Groover/PE/PHI Publishers
3. Automation, Production systems & Computer integrated Manufacturing/Groover/Pearson Education

Reference Books:

1. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age Publishers
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson Edu
3. CAD/CAM: Concepts and Applications/Alavala/ PHI Publishers Computer Numerical Control Concepts and programming / Warren S Seames / Thomson Publishers

Outcomes: The learning outcomes are assessed through the assignment and various practical performed modeling, drafting, computer aided quality control and computer integrated manufacturing systems.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A2124) CIVIL AVIATION RULES AND REGULATIONS (CORE ELECTIVE - IV)

Objectives:

- civil aircraft rules
- Regulations pertaining to DGCA.
- Various Log Books maintained by civil operators.

UNIT I: AIRCRAFT RULES AND CATEGORIES OF AME LICENCE

Knowledge of Aircraft Rules as far as they relate to airworthiness and safety of aircraft. Knowledge of Privileges and responsibilities of the various categories of AME License and approved persons.

UNIT II: CIVIL AIRWORTHINESS REQUIREMENT

Knowledge of "Civil Airworthiness Requirements", "Aero nautical Information Circulars (relating to airworthiness)", "Advisory Circulars" and AME Notices issued by DGCA. Knowledge of various mandatory documents like Certificate of Registration, Certificate of Airworthiness, Flight Manual, Export Certificate of Airworthiness. Method of identifying approved material on Aircraft.

UNIT III: LOG BOOKS AND STORES.

Knowledge of various documents/ certificates issued to establish airworthiness of Aircraft parts. Various logbooks required to be maintained for Aircraft. Method of maintaining the logbook. Procedure for making entries in logbooks; Journey logbook, Technical logbook etc. Use of schedules, its certification, preservation, Stores, Bonded and Quarantine stores, storage of various aeronautical products including rubber goods, various fluids.

UNIT IV: CERTIFICATE OF FLIGHT

Knowledge of various terms such as Certificate of Flight Release, Certificate of Maintenance, Approved Certificates. Condition under which Aircraft is required to be test flown; Certificate to be issued by AME for test flight. Circumstances under which C of A is suspended. Ferry Flight, MEL, CDL. Minimum equipments, instruments required for various types of operation.

UNIT V: AIRCRAFT MODIICATIONS AND TYPE APPROVAL

Modification, concession, Airworthiness Directive, Service Bulletins.Approval of Organisation. Documents required to be carried on board.Issue of Type Approval. Registration markings. Human performance and limitations relevant to the duties of an aircraft maintenance engineer, license holder.

Text books:

1. Aircraft Act, 1934
2. Aircraft Rules
3. DGCA CAR Section 1 and Section 2

Reference Books:

1. Aeronautical information Circular

Outcomes:

- Student will have good knowledge of Civil Aircraft rules.
- Student can write civil AME license.
- He will be familiar with procedures for operation and certification of civil aircraft.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem	L	T/P/D	C
	4	-/-/-	3

(R15A2125) AIRCRAFT MAINTENANCE ENGINEERING
(CORE ELECTIVE - IV)

Objectives:

- To introduce the knowledge of the maintenance and repair procedures followed for overhaul of aero engines.
- To impart the standards of FAA for documentation.

UNIT – I

NECESAITY & DEVELOPMENT OF MAINTENANCE PROGRAMS

Definition of maintenance, role of the engineer, role of the mechanic, two types of maintenance, reliability, establishing a maintenance program. Goals and objectives of maintenance. Maintenance steering group(MSG) Approach, process – Oriented maintenance, task- oriented maintenance, current MSG process – MSG – 3, maintenance program documents.

UNIT – II

AVIATION CERTIFICATION REQUIREMENTS AND DOCUMENTATION FOR MAINTENANCE & ENGINEERING

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. 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 maintence, overhaul shops, material.

UNIT – III

TECHNICAL SERVICES

Engineering: makeup of engineering, mechanics and engineers, engineering department functions, engineering order preparation; production planning & control – forecasting, production planning, production control , Organization of PP&C; technical publications- functions of technical publications, airline libraries, control of publications,; Technical Training-organization, training for aviation maintenance, airframe manufacturer`s training courses,

UNIT – IV

MAINTENANCE AND MATERIAL SUPPORT

Line maintenance(on – aircraft), functions that control maintenance, MCC responsibilities, general line maintenance operations, aircraft logbook, ramp and terminal operations, maintenance crew requirement, morning meeting; Hangar Maintenance (on-aircraft)-organization of hangar maintenance, problem areas in hangar maintenance, maintenance support shops, ground support equipment, typical C – check: Shop data collection; Material support –organization and function of material. Material directorate, M&E support functions

UNIT – V

OVERSIGHT FUNCTIONS, ART & SCIENCE OF TROUBLE SHOOTING

Quality Assurance , quality audits, ISO 9000 quality standard, technical records, Quality control-quality control organization, FAA and JAA QC inspector qualifications. Basic inspection policies,; Reliability – definition and types of reliability, elements of a reliability program, Maintenance safety – safety regulations, maintenance safety program, general safety rules, accident and injury reporting . Human factors in maintenance, Trouble shooting, knowledge of malfunctions, Basic concepts of trouble shooting.

Text Books:

1. Kinnison, H.A , Aviation Maintenance Manageent, Mc Graw – Hill – 2004.
2. Mc Kinley, J.L. Bent, R.D ., Maintenance and Repair of Aerospace Vehicles, Northrop Institute of Technology, Mc Graw Hill, 1967.

Reference Books:

1. Friend, C.H., Aircraft maintence Management . Longman, 1992.
2. Kroes, M., Watkins. W., and Delp. F. Aircraft Maintenance and Repair, Tata Mc Graw – Hill. 2010

Outcomes:

- Ability to maintain and repair the areo engines.
- Ability to prepare aircraft maintenance manuals.
- Ability to know the standards of quality, FAA

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem

L	T/P/D	C
4	-/-/-	3

(R15A2126) HYPERSONIC AERODYNAMICS
(CORE ELECTIVE – IV)

Objectives:

The course should enable the students to:

- Formulate and apply appropriate aerodynamic models to predict the forces on and performance of realistic three-dimensional configurations in hypersonic flows.
- Understand about current aerospace problems like Aerodynamic heating.
- Know about experimental methods for hypersonic flows.

UNIT-I - FUNDAMENTALS OF HYPERSONIC FLOWS AND APPROXIMATIONS

Importance/properties of hypersonic flow-Basic equations boundary conditions for inviscid flow, concept of equilibrium and nonequilibrium flows, transport properties. Basic conservation equations and species continuity equation, hypersonic shock and expansion relations, hypersonic similarity parameters. Newtonian, modified Newtonian.

UNIT-II - HYPERSONIC SMALL DISTURBANCE THEORY

Flow over a wedge and a cone- Blast wave analogy,-Newtonian impact theory- Busemann centrifugal correction -Shock expansion method- Tangent cone and tangent wedge methods Pressure distribution in separated regions and in reacting flows.

UNIT-III - BASIC ASPECTS OF HYPERSONIC VISCOUS FLOWS AND AERODYNAMIC HEATING

Introduction to viscous flow and pressure interactions over flat plate- Boundary layers Reference temperature method-Entropy layer effects on aerodynamic heating.

UNIT-IV - HYPERSONIC VEHICLE DESIGN

Supersonic Inlet design Strong and weak interactions-Shock wave/ boundary layer interactions Concept of SERN, Design aspects of various Hypersonic vehicles like X-43, HSTDV, Hyshot

UNIT-V - EXPERIMENTAL METHODS FOR HYPERSONIC FLOWS:

Arc Jet facilities, Impulse facilities, hypersonic wind tunnels, shock tunnels, gun tunnels, freepiston shock tunnels, expansion tubes etc. Flow visualization techniques, model testing.

Text Books

1. “Hypersonic and High Temperature Gas Dynamics”, Anderson, J.D,McGraw-Hill, 1989.
2. “Hypersonic Aerothermodynamics”, Bertin, J.J., AIAA, 1994.

Reference Books:

1. “Introduction to Hypersonic flow”, Cherni C G, Academic Press,1961
2. “Hypersonic Flow Theory”, Hayes W D and Problein R F, Academic Press 1959
3. “Elements of Hypersonic Aerodynamics”, Cox R N and Crabtree L P, London 1965

Outcomes:

The student should be able to

- Estimation of aerodynamic characteristics of different geometries in hypersonic conditions.
- Application aerodynamic theories in the design hypersonic vehicles.
- Validation of experimental results with analytical results.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem	L	T/P/D	C
	0	-/3/-	2

(R15A2186)COMPUTATIONAL AERODYNAMICS LAB

Objectives:

- To develop an understanding for the major theories, approaches and methodologies used in CFD.
- To build up the skills in the actual implementation of CFD methods (e.g. boundary conditions, turbulence modeling etc.) in using commercial CFD codes.
- To gain experience in the application of CFD analysis to real engineering designs.

LIST OF EXPERIMENTS:

1. Solution for the one dimensional wave equations using explicit method of lax using finite Difference method (code development)
2. Solution for the one dimensional heat conduction equation using explicit method using finite difference method (code development)
3. Generation of the Algebraic Grid (code development)
4. Generation of the Elliptic Grids (code development)
5. Numerical simulation of Flow over an airfoil using commercial software
6. Numerical simulation of Supersonic flow over a wedge using commercial Software
7. Numerical simulation of Flat plate boundary layer using commercial software
8. Numerical simulation of Laminar flow through pipe using commercial software
9. Numerical simulation of Flow past cylinder using commercial software
10. Numerical simulation of flow through nozzle using commercial software
11. Numerical simulation of flow over wing using commercial software
12. Numerical simulation of combustion using commercial software

Note: Any 10 Experiments can be conducted.

Equipment Needed:

1. **Computers**: Core 2 duo processor with 1 GB RAM
2. **Softwares:** Matlab or scilab and Ansys or equivalent softwares

Reference Books:

1. MATLAB an Introduction with Applications Fifth Edition AMOS GILAT by WILEY Publications
2. Programming in SCI lab by VINU V DAS New Age International Publications
3. ANSYS FLUENT and CFX Tutorials

Outcomes:

- Students will develop a better intuition of Aerodynamics more quickly than is possible with traditional analytical approaches.
- Ability to undertake problem identification, formulation and solution and apply knowledge of basic science and engineering fundamentals.
- Developing a geometrical model of the flow, applying appropriate boundary conditions, specifying solution parameters, and visualizing and analyzing the results.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-I Sem	L	T/P/D	C
	0	-/3/-	2

(R15A2187)COMPUTATIONAL STRUCTURES LAB

Objectives:

- To obtain an understanding of the fundamental theory of the FEA method;
- To understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements; and
- To understand the application and use of the FE method for Aerospace problems.

LIST OF EXPERIMENTS:-

1. Stress Analysis of Thickened Thin Walled Open Section Panel.
2. Torsional Strength and Shear Force of Thin Walled Closed Section Panel.
3. Computational Analysis of Rectangular Stiffened Panel.
4. Static Analysis of Cantilever Beam.
5. Computational Analysis of Truss Structure.
6. Computational Analysis of Landing Gear.
7. Computational Analysis of Nose Cone.
8. Computational Analysis of Tapered Wing Structure.
9. Computational Analysis of Fuselage Structure
10. Computational Analysis of Nozzle.

Note: Total 10 experiments are to be conducted.

Equipment Needed:

1. **Computers**: Core 2 duo processor with 1 GB RAM
2. **Softwares:** Ansys or NASTRAN or equivalent

Reference Books:

1. Aircraft STRUCTURES for Engineering Students 4th Edition by THG MEGHSON
2. Finite Element Simulations with ANSYS by Huei-Huang Lee

Outcomes:

- The ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software;
- To demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes;
- To develop a basic understanding of the limitations of the FE method and understand the possible error sources in its use.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-II Sem	L	T/P/D	C
	5	1/-/-	4

(R15A2127)HELICOPTER AERODYNAMICS
(CORE ELECTIVE - V)

Objectives:

- To understand the basic concepts of Helicopter flying, different configurations
- To understand the difference between Aircraft and Helicopter principles, mechanisms
- To understand the principles, theories and stability and control pertaining to it

UNIT I

INTRODUCTION.

Historical Development of Helicopters, Helicopter Configuration, Control Requirements, Types of Rotor Systems, Basic Power Requirements.

UNIT II

INTRODUCTION TO HOVERING THEORY.

Momentum Theory, Blade Element Theory, Combined Blade Element and Momentum theories for non-uniform inflow calculation, Ideal Rotor vs. Optimum Rotor.

UNIT III

VERTICAL FLIGHT.

Various flow states of Rotor, Autorotation in Vertical Descent, Ground Flight.

UNIT IV

FORWARD FLIGHT.

Momentum Theory, Variable Inflow Models, Blade Element Theory, Rotor Reference Planes, Hub Loads, Power variation with forward speed, Rotor Blade flapping Motion: Simple Model.

UNIT V

HELICOPTER TRIM AND STABILITY.

Equilibrium condition of helicopter, Trim analysis, Basics of helicopter stability.

Text Books:

1. Gessow.A and Meyers G.C. Aerodynamics of Helicopter,Macmillan& co ., N.Y.1987
2. Johnson W Helicopter theory, Princeton University pres 1980
3. MccormickB.W.Aerodynamics,Aeronautics& Flight mechanics ,John Wiley ,1995
4. Gupta. L Helicopter Engineering, Himalayan Books 1996
5. Bramwell A.R.S Helicopter Dynamics Edward Arnold Publications London 1976
6. Stepniewski W.Z Rotary Rotary wing Aerodynamics Vol 1 & 2 Dover publications 1984

Outcomes:

- The student will be able to identify the key differences between Aircraft and Helicopter
- The analyze the basic concepts, theories regarding forward and hovering Flight
- The significance of Stability and Control in different conditions

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

	L	T/P/D	C
IV Year B. Tech, ANE-II Sem	**5**	**1/-/-**	**4**

(R15A2128)ADVANCED COMPUTATIONAL AERODYNAMICS
(CORE ELECTIVE – V)

Objectives:

- Application of panel methods to find aerodynamic characteristics of flow over geometries.
- Understand method of characteristics governing aerodynamic flows.
- Numerical methods to solve fluid flow problems

UNIT - I

PANEL METHODS

Introduction to panel method, Basic aspects of uniform source and vortex flows, Source panel method – Non-lifting flows over arbitrary two-dimensional bodies. Vortex panel method – Lifting flows over arbitrary two-dimensional bodies.

UNIT – II

METHOD OF CHARACTERISTICS

Introduction to numerical techniques for steady supersonic flows, Philosophy of method of characteristics. Determination of characteristic lines – Two-dimensional irrotational flow. Determination of the compatibility equation and unit processes. Regions of influence and Domains of dependence.

UNIT – III

TRANSONIC RELAXATION METHOD

Theoretical aspects of transonic flows, Small Perturbation flows - Transonic small perturbation equations - Central and Backward difference schemes, Shock capturing vs. shock fitting techniques: Conservation vs. non conservation forms of governing equations, Line relaxation techniques.

UNIT - IV

BOUNDARY LAYER EQUATION

Introduction to boundary layer equations and their solutions. Description of the boundary layer equations. Transformation of boundary layer equations and the numerical solution method. Choice of discretization model and the generalized Crank- Nicholson Scheme. Discretization of boundary layer equations and illustration of solutions of a tridiagonal system of linear algebraic equations.

UNIT - V

TIME DEPENDENT METHODS

Stability of Solution, Explicit time dependent methods - Euler, Backward Euler, One step trapezoidal, Backward differencing, methods, Leap Frog method.

Text Books:

1. John .D. Anderson “Computational Fluid Dynamics”, McGraw Hill
2. Anderson, Dale A., John C. Tanhill and Richard H.P Letcher, “Computational Fluid Mechanics and Heat transfer”, McGraw Hill, New York 1984, Volumes I & II.

Reference Books:

1. Hoffmann, K.A: Computational Fluid Dynamics for Engineers, Engineering Education System, Austin, Tex., 1989
2. Kreyszig, E., Advanced Engineering Mathematics, Wiley, New York
3. Introduction to Computational Fluid Dynamics, Chow CY, John Wiley, 1979
4. Bose, T.K., Computation Fluid Dynamics, Wiley Eastern Ltd., 1988.

Outcomes:

- Solve differential equations governing fluid flow problems.
- CFD Techniques for boundary layer problems.
- Application of Time dependent techniques for transient aerospace problems.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-II Sem

L	T/P/D	C
5	1/-/-	4

(R15A0323) HEAT TRANSFER
(CORE ELECTIVE – V)

Objectives: The objective of this subject is to provide knowledge about Heat transfer through conduction, convection and radiation.

Codes/Tables: Heat and Mass Transfer data book

UNIT-I:

Introduction: Basic modes of heat transfer- Rate equations- Generalized heat conduction equation in Cartesian, Cylindrical and Spherical coordinate systems. Steady state heat conduction solution for plain and composite slabs, cylinders and spheres- Critical thickness of insulation- Heat conduction through fins of uniform and variable cross section- Fin effectiveness and efficiency.

Unsteady state Heat Transfer conduction- Transient heat conduction- Lumped system analysis, and use of Heisler charts.

UNIT-II:

Convection: Continuity, momentum and energy equations- Dimensional analysis- Boundary layer theory concepts- Free, and Forced convection- Approximate solution of the boundary layer equations- Laminar and turbulent heat transfer correlation- Momentum equation and velocity profiles in turbulent boundary layers- Application of dimensional analysis to free and forced convection problems- Empirical correlation.

UNIT-III:

Radiation: Black body radiation- radiation field, Kirchoff's laws- shape factor- Stefan Boltzman equation- Heat radiation through absorbing media- Radiant heat exchange, parallel and perpendicular surfaces- Radiation shields.

UNIT-IV:

Heat Exchangers: Types of heat exchangers- Parallel flow- Counter flow- Cross flow heat exchangers- Overall heat transfer coefficient- LMTD and NTU methods- Fouling in heat exchangers- Heat exchangers with phase change.

Boiling and Condensation: Different regimes of boiling- Nucleate, Transition and Film boiling. Condensation: Laminar film condensation- Nusselt's theory- Condensation on vertical flat plate and horizontal tubes- Drop wise condensation.

UNIT-V: Mass Transfer: Conservation laws and constitutive equations- Isothermal equimass, Equimolal diffusion- Fick's law of diffusion- diffusion of gases, Liquids- Mass transfer coefficient.

Text Books

1. Heat Transfer, by J.P.Holman, Int.Student edition, McGraw Hill Book Company.
2. Fundamentals of Heat and Mass Transfer- Incropera and Dewitt
3. Heat transfer by Sukhatme

Reference Books:

1. Heat and Mass Transfer- Arora and Domkundwar
2. Essential of Heat Transfer by Christopher A. Long
3. Heat transfer by Yunus A Cengel

Outcomes:

- Knowledge and understanding how heat and energy is transferred between the elements of a system for different configurations, Solve problems involving one or more modes of heat transfer**.**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-II Sem

L	T/P/D	C
5	1/-/-	4

(R15A2129)AEROELASTICITY
(CORE ELECTIVE – VI)

Objectives:

The course should enable the students to:

- To elucidate the aero elastic Phenomena and formulations
- Find solution techniques for aerospace vehicles in flight and to incorporate the spin off benefits.
- Understand the application of aero elasticity and its effect on aircraft components.

UNIT-I INTRODUCTION TO AEROELASTICITY

Definition and historical background, Static and dynamic aeroelastic phenomenon, integretion of aerodynamic, elastic and inertia forces, influence of aeroelstic phenomenon on air craft design, Comparison of critical speeds.

UNIT-II DIVERGENCE OF LIFTING SURFACE

The phenomenon of divergence, divergence of 2-D wing section, divergence of an idealized cantilever wing, solution based on semi-rigid assumptions, solution to generalized co-ordinates Method of successive approximation, use of Numerical Methods.

UNIT-III STEADY STATE AERO-ELASTICITY PROBLEMS IN GENERAL

Loss and reversal of aileron Control: 2D case, aileron reversal general case. Lift distribution on a rigid and elastic wing. Effect on Static Longitudinal stability of airplane.

UNIT-IV INTRODUCTION TO FLUTTER AND BUFFETING

The phenomenon of flutter, flutter of a cantilever wing. Approximate determination of critical speed by Galerkin's Method, buffeting and stall flutter.

UNIT-V NON AERONAUTICAL PROBLEMS

Some typical example in civil engineering, Flow around an oscillating circular cylinder applications to H-shaped sections, Prevention of aero-elastic instabilities.

Text Books:

1. Fung Y.C. an introduction to the Theory of Aeroelasticity John Wiley and Sons, New York, 1985.
2. Bisphlinghoft R. C. Ashlay. H and Halfmam. R Aero-elasticity – Addition Werley Publishing Company.
3. Scnlan R.H. and Rosenbaum. R Introduction to the study of Aircraft Vibrations and Flutter McGraw Company New York 1981.

Reference Books:

Bisphlinghoft R. C. and Ashely, Principles of Aeroelasticity Johnwiley Company. 1998.

Outcomes:

The student should be able to:

- Understand the formation of Aileron reversal, flutter and wing divergence.
- Control aero elastic problems on fight stability and control.
- Application Aero elastic theories to Non aeronautical problems.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-II Sem

L	T/P/D	C
5	1/-/-	4

(R15A0370)FATIGUE AND FRACTURE MECHANICS
(CORE ELECTIVE – VI)

Objectives:

- To study the concepts of estimation of the endurance and failure mechanism of components
- Failure investigation has been based on Fatigue and fracture mechanics.
- To predict the critical loads that will cause catastrophic failure in a structure.

UNIT I

FATIGUE OF STRUCTURES: S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves.

UNIT II

STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR: Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques –Cumulative damage - Miner's theory - Other theories.

UNIT III

PHYSICAL ASPECTS OF FATIGUE: Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations – fatigue fracture surfaces.

UNIT IV

FRACTURE MECHANICS: Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - stress analysis of cracked bodies – Effect of thickness on fracture toughness - stress intensity factors for typical geometries.

UNIT V

FATIGUE DESIGN AND TESTINIG: Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Applica¬tion to composite materials and structures.

Text Books:

1. Elements of fracture mechanics by Prasanth Kumar –– Wheeter publication, 1999.
2. Fatigue of aircraft structure by Barrois W, Ripely, E.L., Pergamon press. Oxford, 1913.

Reference Books:

1. Mechanics of fracture Vol. I by Sin, C.G., Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1919.
2. Fundamentals of Fracture Mechanics by Knott, J.F., Buterworth & Co., Ltd., London, 1913

Outcomes:

- Application of fracture mechanics to engineering issues.
- The subjects covered by this special collection include the fatigue life of structural elements.
- Exposure on nonlinear fracture-mechanics parameters, such as the J and T integrals.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ANE-II Sem

L	T/P/D	C
5	1/-/-	4

(R15A2130) AIRLINE AND AIRPORT MANAGEMENT
(CORE ELECTIVE – VI)

Objectives:
To understand and acquire a sound understanding on basic management aspect of airport and airlines system such as airports layout, air traffic control, landing procedure, scheduling, flight planning and other economic and commercial activities.

UNIT I
AIRPORT SYSTEMS: An introduction, Airports and airport systems: Organization and administration. A historical and Legislative perspective.

UNIT II
AIRPORT OPERATIONS MANAGEMENT: The airfield, Airspace and air traffic management, Airport operations management under FAR Part 139, Airport terminals and ground access, Airport security.

UNIT III
AIRPORT ADMINISTRATIVE MANAGEMENT: Airport financial management, The economic, political, and social role of airports, Airport planning, Airport capacity and delay, The future of airport management.

UNIT IV
INTRODUCTION TO AIRLINE PLANNING: Structure of Airline Industry (Domestic & International)-Growth and Regulation-Deregulation-Major and National Carriers-Regional Carriers-Economic characteristics of the Airlines Airline Planning Process-Airline Terminology and Measures: airline demand, airline supply, average load factor, unit revenue, Airline Planning Decisions: Fleet Planning, Route Evaluation, Schedule Development, Pricing, Revenue Management

UNIT-V
FLEET PLANNING AND ROUTE EVALUATION: Factors in Fleet Planning-Hub-and-Spoke System-Technical Aspects-Fleet Rationalization-Fleet Commonality-Long Range Aircraft-Noise Restrictions-Factors in Design and Development-Fleet Planning Process; Route Evaluation in Hub Networks-Route profitability estimation issues-Demand Driven Dispatch.

Text Books
1. Airport Planning and Management 6/E 0006 Edition by Young Seth, Mc GRAW Hills.
2. Airport Management by Ravindran P.C.K, Asian Law House.
3. Air Transportation: A Management Perspective (Fifth Edition) by Alexander T.Wells and John G.Wensveen, Brooks Cole,2003

Reference Books:
1. Airport Systems: Planning, Design and Management by Rechard De Neufville Tata Mc Graw Hills.
2. Airline Marketing and Management by Stephen Shaw, Ashgate Publishing, 2004
3. Airline Management, by Peter P BelobabaMIT Open Courseware Lecture Notes, 2006

Outcomes:

- The student can get an broad overview and functioning of the airline industry. It focuses on the underlying marketing, financial, operational and competitive factors that influence airline viability.
- The student can investigate how the sensitivity of airline profitability impacts airline management decisions and analyze the principles of airline economics, costs and pricing.
- The student and assess the individual characteristics of low-cost carriers and business only airlines.