B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

REGULATIONS 2013
FOR
B.TECH. DEGREE PROGRAMMES

UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science & Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

To blossom into an internationally renowned University

To empower the youth through quality education and to provide professional leadership

To achieve excellence in all its endeavors to face global challenges

To provide excellent teaching and research ambience

To network with global Institutions of Excellence, Business, Industry and Research Organizations

To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF AEROSPACE ENGINEERING

VISION

Department of Aerospace Engineering aspires to be a center of excellence in Aerospace Engineering Education, Training and Research and contribute for the development of Aerospace Technology

MISSION

To provide quality education and training in Aerospace Engineering to bring out motivated and capable aerospace engineers and scientists

To create stimulating environment and supportive infrastructure for research and scholarly development in Aerospace and related areas

To undertake collaborative research with Aerospace and related industries to solve problems of interest

To provide analytical skills, leadership quality and team sprit through balanced curriculum and a judicial mix of co-curricular, extra-curricular and professional society activities.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

B.TECH. (AERONAUTICAL)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge in science, engineering and technology relating to Aeronautical/Aerospace Engineering.
- To impart adequate knowledge and skills required for aircraft/aerospace industry, research organization and advance their careers and achieve positions of increasing responsibility, and/ or pursue entrepreneurial endeavors.
- To develop the technical expertise in design, analysis, manufacturing and maintenance management of flight vehicles and their components.
- To provide exposure to the advancements in aeronautical science and engineering and related fields.
- To inculcate a sense of commitment to the profession through involvement with the community and professional organization.

PROGRAMME OUTCOMES

The graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 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.

- 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.
- 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.
- 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.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 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.
- 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 multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological

PROGRAMME SPECIFIC OUTCOMES

- Formulate and solve problems in Aeronautical Engineering using the knowledge acquired in core areas of aerodynamics, aircraft structures, propulsion, materials, flight dynamics and avionics.
- Design aircraft systems, components and processes to meet desired needs within realistic constraints.

REGULATIONS - 2013 FOR
B.TECH. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

"Programme" means B.Tech. Degree Programme.

"Branch" means specialization or discipline of B.Tech Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

"Course" means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.,

"University" means B.S.Abdur Rahman University.

"Dean (Academic Affairs)" means the Dean (Academic Affairs) of B.S. Abdur Rahman University.

"Dean (Student Affairs)" means the Dean (Students Affairs) of B.S.Abdur Rahman University.

"Controller of Examinations" means the Controller of Examination of B.S. Abdur Rahman University, who is responsible for conduct of examinations and declaration of results.

2.0 ADMISSION

2.1a) Candidates for admission to the first semester of the eight semester B.Tech. degree programme shall be required to have passed the Higher Secondary Examination of the (10+2) curriculum (Academic stream) prescribed by the appropriate authority or any other examination of any university or authority accepted by the University as equivalent thereto.

2.1b) Candidates for admission to the third semester of the eight semester B.Tech. programme under lateral entry scheme shall be required to have passed the Diploma examination in Engineering / Technology of the Department of Technical Education, Government of Tamil Nadu or any other examination of any other authority accepted by the University as equivalent thereto.

2.2 Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination prescribed by the University for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream.

2.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the University from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. degree programmes in various branches of Engineering and Technology, each distributed over eight semesters with two semesters per academic year.

B.TECH. DEGREE PROGRAMMES:

Aeronautical Engineering
Automobile Engineering
Civil Engineering
Computer Science and Engineering
Electrical and Electronics Engineering
Electronics and Communication Engineering
Electronics and Instrumentation Engineering
Information Technology
Manufacturing Engineering
Mechanical Engineering
Polymer Engineering

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every Programme will have a curriculum with syllabi consisting of theory and practical courses such as,

Basic Sciences (BS)
Humanities & Social Sciences (HS)
Management Sciences (MS)
Engineering Sciences Fundamentals (ESF)
Engineering Core Courses (EC)
Professional Electives (PE)

General Electives (GE)

Workshop practice, laboratory work, industrial training, seminar presentation, project work, etc.

4.2 Each course is normally assigned certain number of credits :

one credit per lecture period per week

one credit per tutorial period per week

one credit for two to three periods and two credits for four periods of laboratory or practical courses

one credit for two periods of seminar / project work per

week one credit for two weeks of industrial internship

4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding seven and practical courses not exceeding four.

4.4 For the award of the degree, a student has to earn a minimum total credits specified in the curriculum of the relevant branch of study. This minimum will be between 175 and 185 credits, depending on the program.

4.5 The medium of instruction, examinations and project report shall be English, except for courses on languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is ordinarily expected to complete the B.Tech. programme in eight semesters (six semesters in the case of a lateral entry scheme), but in any case not more than 14 continuous semesters reckoned from the date of first admission (12 semesters in the case of lateral entry student).

5.2 Each semester shall consist of a minimum of 90 working days or 450 periods.

5.3 Semester end examination will normally follow immediately after the last working day of the semester.

6.0 CLASS ADVISOR AND FACULTY ADVISOR

6.1 CLASS ADVISOR

A faculty member will be nominated by the HOD as Class Advisor for the whole class (2_{nd} to 8_{th} semester).

He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

However, for the first semester alone the class advisors and faculty advisors will be nominated by first year coordinator.

6.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment every semester.

7.0 COURSE COMMITTEE

Common course offered to more than one discipline or group, shall have a "Course Committee", comprising all the faculty members teaching the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs), depending on whether all the faculty members teaching the common course belong to the same department / different departments.

8.0 CLASS COMMITTEE

During first semester, a common Class Committee will be constituted for all branches by the Dean (Academic Affairs). During other semesters, separate Class Committees will be constituted by the respective Head of the Department of the students

8.1 The first semester Class Committee composition will be as follows:

Coordinator for the first semester shall be the Chairman of the class committee

Course coordinators of all common courses.

Faculty members of all individual courses.

One male and one female first semester student of each class of B.Tech, program to be nominated by the first semester coordinator

All first semester class advisors and faculty advisors

8.2 The composition of the class committee for each branch of B.Tech, from 2nd to 8th semester, will be as follows:

One senior faculty member preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department

Faculty members of individual courses

Two students, (preferably one male and one female) of the class per group of 30 students or part thereof, to be nominated by the Head of the Department, in consultation with the faculty advisors.

All faculty advisors and the class advisor of the class

Head of the Department

8.3 The class committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment will be decided for the first, second and third assessments. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

8.4 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

8.5 The class committee, excluding the student members and the invited members, shall meet within 10 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide the grades for students in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator. If the course is common to more than one branch of study, grades for such courses shall be finalized in the course committee meetings in consultation with the Dean (Academic Affairs).

9.0 REGISTRATION AND ENROLMENT

9.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the semester end examination of the current semester. Every student shall submit a completed Registration

form indicating the list of courses intended to be enrolled during the ensuing semester. Late registration with the approval of Dean (Academic Affairs) along with a late fee will be permitted up to the last working day of the current semester.

9.2 From the second year onwards, all students shall pay the prescribed fees for the year on a specific day at the beginning of the semester confirming the registered courses. Late enrolment along with a late fee will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

9.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

9.4 A student should have registered and enrolled for all preceding semesters before registering for a particular semester.

10.1 CHANGE OF A COURSE

A student can change an enrolled course within 15 days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

10.2 WITHDRAWAL FROM A COURSE

A student can withdraw from an enrolled course at any time before the second assessment for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

11.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

A student can avail a onetime temporary break of study covering the current semester and/or next semester period with the approval of the Head of the Institution at any time before the start of third assessment of current semester, within the maximum period of 14 or 12 semesters as the case may be. If any student is debarred for want of attendance or suspended due to any act of indiscipline it will not be considered as break of study.

A student availed break of study has to rejoin only in the same semester from where he left.

12.0 CREDIT LIMIT FOR ENROLMENT & MOVEMENT TO HIGHER SEMESTER

12.1 A student can enroll for a maximum of 30 credits during a semester including redo courses.

12.2 The minimum credit requirement to move to the higher semester is

Not less than a total of 20 credits, to move to the 3rd semester

Not less than a total of 40 credits, (20 for lateral entry) to move to the 5th semester

Not less than a total of 60 credits, (40 for lateral entry) to move to the 7th semester

12.3 However, a student who has secured "I" grade (due to shortage of attendance) in all the courses of a particular semester is not eligible to move to the next higher semester.

13.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

13.1 Every theory course shall have a total of four assessments during a semester as given below:

Assessment No.	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 4	1.5 hours	15%
Assessment 2	5 to 8	1.5 hours	15%
Assessment 3	9 to 12	1.5 hours	15%
Attendance #	-	-	5%
Semester End Exam	1 to 18 (full course)	3 hours	50 %

76-80% - 1 Mark ; 81-85 - 2 Marks ; 86-90 - 3 Marks ; 91-95 - 4 Marks and 96 - 100 - 5 Marks

13.2 Appearing for semester end examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

13.3 Every practical course will have 60% weightage for continuous assessment and 40% for semester end examination. However, a student should have secured a minimum of 50% marks in the semester end practical examination.

13.4 In the case of Industrial training, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members, constituted by the Head of the department. A progress report from the industry will also be taken into account for evaluation.

13.5 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student(s), an oral examination (viva-voce) will be conducted as the semester end examination, for which one external examiner, approved by the Controller of Examinations, will be included. The weightage for periodic review will be 50% and remaining 50% for the project report and Viva Voce examination.

13.6 Assessment of seminars and comprehension will be carried out by a committee of faculty members constituted by the Head of the Department.

13.7 The continuous assessment marks earned for a course during his/her first appearance will be used for grading along with the marks earned in the semester-end examination / arrear examination for that course until he/she completes.

14.0 SUBSTITUTE EXAMINATIONS

14.1 A student who has missed, for genuine reasons, a maximum of one of the four assessments of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness, etc. by a committee constituted by the Dean of School for that purpose.

14.2 A student who misses any assessment in a course shall apply in a prescribed form to the Head of the department / Dean within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

15.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

15.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the University in approved events etc.) to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

15.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department. Thereupon, the Dean (Academic Affairs) shall announce, course-wise, the names of such students prevented from writing the semester end examination in each course.

15.3 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

15.4 A student who is awarded "U" or “AB” grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course during summer term / regular semester. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the end-semester (re-do) examination. If any student obtained "U" grade during summer term course, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

15.5 If a student with "U" or “AB” grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will be awarded "I" grade in that course.

16.0 SUMMER TERM COURSES

16.1 A student can register for a maximum of three courses during summer term, if such courses are offered by the concerned department during the summer term. Students may also opt to redo such courses during regular semesters.

16.2 The Head of the Department, in consultation with the department consultative committee may arrange for the conduct of a few courses during the summer term, depending on the availability of faculty members during summer and subject to a specified minimum number of students registering for each of such courses.

16.3 However, in the case of students who have completed eighth semester, but having arrears in the earlier semesters in a maximum of two courses, summer courses may be offered, even if less than minimum students are registering for the course.

16.4 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.

17.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

17.1 All assessments of a course will be made on absolute marks basis. However, the Class Committee without the student members and the invited members shall meet within 10 days after the semester-end examination and analyze the performance of students in all assessments of a course and award letter grade. The letter grades and the corresponding grade points are as follows:

Letter Grades	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
I	--
W	--
AB	--

"W" denotes withdrawal from the course

"I" denotes inadequate attendance in the course and hence prevented from writing semester-end examination.

"U" denotes unsuccessful performance in the course.

"AB" denotes Absent for the semester end examination

17.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student.

17.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department and declared by the Controller of Examinations.

17.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester-end theory examination answer scripts of courses, on payment of prescribed fees, through proper application to Dean (Academic Affairs). The concerned HOD shall constitute a revaluation committee consisting of Chairman of the class committee as convener, the faculty member of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

17.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details. The list of courses enrolled during the semester including summer term courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses, if any.

If Ci, is the number of credits assigned for the ith course and GPi is the Grade Point in the ith course

$$GPA = \frac{\sum_{i=1}^{n} (C_i)(GPi)}{\sum_{i=1}^{n} C_i} \qquad \textit{Where } n = \textit{number of courses}$$

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and **"W"** grades will be excluded for calculating GPA .

"U", "I", "AB" and **"W"** grades will be excluded for calculating CGPA

17.6 After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA.

Classification	**CGPA**
First Class with Distinction	8.50 and above and passing all the courses in the first appearance and completing the programme within the normal 8 or 6 (for lateral entry) semesters
First Class	6.50 and above and completing the programme within a maximum of 10 or 8 (for lateral entry) semesters.
Second Class	All others

However, to be eligible for First Class with Distinction, a student should not have obtained U or I grade in any course during his/her study and should have completed the U.G. Programme within a minimum period covered by the minimum duration plus authorized break of study, if any (clause 11). To be eligible for First Class, a student should have passed the examination in all courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

18.0 ELECTIVE CHOICE: OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

18.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

18.2 In the curriculum of eighth Semester, along with the project work, if two elective courses alone are listed, then the Dean (Academic Affairs) may permit a

student, as per approved guidelines, on the recommendation of the Head of the department, to do a full semester major industrial project work. In such a case, the above two elective courses or any other two elective courses in lieu thereof have to be enrolled during any semester including the summer, preceding or succeeding the project work, if offered.

19.0 PERSONALITY AND CHARACTER DEVELOPMENT

19.1 All students shall enroll, on admission, in any of the personality and character development programmes, NCC / NSS / NSO / YRC / Rotaract and undergo practical training.

National Cadet Corps (NCC) will have to undergo specified number of parades.

National Service Scheme (NSS) will have social service activities in and around Chennai.

National Sports Organization (NSO) will have sports, games, drills and physical exercises.

Youth Red Cross (YRC) will have social service activities in and around Chennai.

Rotaract will have social service activities in and around Chennai.

20.0 DISCIPLINE

20.1 Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

20.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HODs will be referred to a Discipline and Welfare Committee, nominated by the Vice-Chancellor, for taking appropriate action.

21.0 ELIGIBILITY FOR THE AWARD OF DEGREE

21.1 A student shall be declared to be eligible for the award of B.Tech. degree provided the student has:

successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semester (12 semesters for lateral entry) from the date of admission, including break of study.

no disciplinary action pending against him/her.

21.2 The award of the degree must have been approved by the University.

22.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

CURRICULUM AND SYLLABI FOR B.TECH. AERONAUTICAL ENGINEERING (Eight Semesters / Full Time)

CURRICULUM

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	BS	MAB1181	Algebra, Geometry and Calculus	3	1	0	4
2	HS	ENB1181 FRB1181 ISB1181	English* French* Arabic*	3	0	0	3
3	BS	PHB1181	Physics	3	0	0	3
4	BS	CHB1181	Chemistry	3	0	0	3
5	ESF	GEB1101	Engineering Graphics	2	0	3	3
6	HS	SSB1182	Sociology, Ethics & Human Values	3	0	0	3
7	BS	PHB1182	Physics Lab	0	0	2	1
8	BS	CHB1182	Chemistry Lab	0	0	2	1
9	ESF	GEB1102	Basic Engineering Practices Laboratory	0	0	2	1
10	ESF	GEB1103	Computer Programming & Applications	2	0	2	3
							25

* Any one language

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAB1282	Advanced Calculus	3	1	0	4
2.	BS	PHB1283	Physics of Engineering Materials	3	0	0	3
3.	HS	SSB1181	Introduction to Economics	3	0	0	3
4.	ESF	GEB1211	Basic Engineering Mechanics	3	1	0	4
5.	EC	AEB1211	Fluid Mechanics	3	1	0	4

6.	EC	AEB1212	Introduction to Aeronautical Engineering	3	0	0	3
7.	HS	ENB1282	Written Communication	0	0	2	1
8.	ESF	AEB1213	Fluid Mechanics Lab	0	0	2	1
9.	BS	PHB 1284	Physics of Engineering Materials Lab	0	0	2	1
							24

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAB 2181	Transforms and Applications	3	1	0	4
2.	BS	LSB2181	Biology for Engineers	3	0	0	3
3.	ESF	AEB2101	Solid Mechanics	3	1	0	4
4.	ESF	AEB2102	Engineering Thermodynamics	3	1	0	4
5.	ESF	AEB2103	Introduction to Manufacturing Process	3	0	0	3
6.	EC	AEB2104	Low Speed Aerodynamics	3	0	0	3
7.	HS	ENB2181	Oral Communication	0	0	2	1
8.	ESF	AEB2105	Solid Mechanics Lab	0	0	3	1
9.	ESF	AEB2106	Thermodynamics Lab	0	0	3	1
							24

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAB2283	Applied Numerical Methods	3	1	0	4
2.	EC	AEB2211	High speed Aerodynamics	3	1	0	4
3.	EC	AEB2212	Aircraft Structural Mechanics	3	0	0	3
4.	EC	AEB2213	Propulsion I	3	0	0	3
5.	EC	AEB2214	Aircraft systems and Instrumentation	3	0	0	3
6.	HS	SSB2181	Law for Engineers	3	0	0	3

7.	HS	ENB2282	Confidence Building & Behavioral Skills	0	0	2	1
8.	EC	AEB2215	Aircraft Component Drawing Lab	0	0	3	1
9.	EC	AEB2216	Aerodynamics Lab	0	0	3	1
10.	EC	AEB2217	Aircraft systems Lab	0	0	3	1
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SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EC	AEB3101	Propulsion II	3	1	0	4
2.	EC	AEB3102	Experimental Aerodynamics	3	0	0	3
3.	EC	AEB3103	Aircraft Structural Analysis	3	1	0	4
4.	EC	AEB3104	Aircraft Materials	3	0	0	3
5.	MS	MSB3181	Management of Business organization	3	0	0	3
6.	PE		Professional Elective I	3	0	0	3
7.	HS	ENB3181	Career Building & People Skill	0	0	2	1
8.	EC	AEB3105	Aircraft Structures Lab	0	0	3	1
9.	EC	AEB3106	Propulsion Lab	0	0	3	1
10.	EC	AEB3107	CAD/CAM Lab	0	0	3	1
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SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EC	AEB 3211	Flight Dynamics	3	0	0	3
2.	EC	AEB 3212	Theory of Elasticity	3	0	0	3
3.	EC	EIB 3281	Basic Electronics and Control Systems	3	0	0	3
4.	BS	GEB3201	Environmental Science & Engineering	3	0	0	3
5.	PE		Professional Elective II	3	0	0	3
6.	PE		Professional Elective III	3	0	0	3

7.	EC	AEB3213	Aircraft Design Project-I	1	0	3	2
8.	EC	AEB3214	Aircraft Structure Repair & Engine Maintenance Lab	0	0	3	1
9.	EC	EIB3282	Basic Electronics and Control Systems Lab	0	0	3	1
							22

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EC	AEB4101	Avionics	3	0	0	3
2.	EC	AEB4102	Experimental Stress Analysis	3	0	0	3
3.	EC	AEB4103	Heat Transfer	3	0	0	3
4.	PE		Professional Elective IV	3	0	0	3
5.	PE		Professional Elective V	3	0	0	3
6.	GE		General Elective I	3	0	0	3
7.	EC	AEB4104	Aircraft Design Project-II	1	0	3	2
8.	EC	AEB4105	Avionics Lab	0	0	3	1
9.	EC	AEB4106	CFD and Structural Simulation Lab	0	0	3	1
							22

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE		Professional Elective VI	3	0	0	3
2.	GE		General Elective II	3	0	0	3
3.	EC	AEB4211	Project	0	0	18	9
							15

Total Credits: 180

PROFESSIONAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title
1	PE	AEBX01	Viscous Flows
2	PE	AEBX02	Hypersonic Aerodynamics
3	PE	AEBX03	Introduction to CFD
4	PE	AEBX04	Helicopter Aerodynamics
5	PE	AEBX05	Industrial Aerodynamics
6	PE	AEBX06	Theory of Vibrations
7	PE	AEBX07	Theory of Plates and shells
8	PE	AEBX08	Fatigue and Fracture
9	PE	AEBX09	Finite Element Method
10	PE	AEBX10	Composite Materials and Structures
11	PE	AEBX11	Aero Elasticity
12	PE	AEBX12	Behavior of Materials at High Temperatures
13	PE	AEBX13	Rocket Propulsion
14	PE	AEBX14	Turbomachinery Aerodynamics
15	PE	AEBX15	Combustion
16	PE	AEBX16	Advanced Propulsion
17	PE	AEBX17	Rockets and Missiles
18	PE	AEBX18	Air Traffic control and Aerodrome Design
19	PE	AEBX19	Aviation rules and regulation
20	PE	AEBX20	Aircraft General Engineering & Maintenance Practices

GENERAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	Offering Department
1.	GE	GEBX01	Disaster Management	Civil
2.	GE	GEBX02	Nano Technology	Physics
3.	GE	GEBX03	Control Systems	EEE
4.	GE	GEBX04	Green Design and Sustainability	Civil
5.	GE	GEBX05	Knowledge Management	CSE
6.	GE	GEBX06	Appropriate Technology	Civil / Mechanical
7.	GE	GEBX07	System Analysis and Design	Mechanical
8.	GE	GEBX08	Value Analysis and Engineering	Mechanical
9.	GE	GEBX09	Optimization Techniques	Mathematics
10.	GE	GEBX10	Engineering System Modeling and Simulation	Mechanical
11.	GE	GEBX11	Supply Chain Management	CBS
12.	GE	GEBX12	Total Quality Management	Mechanical
13.	GE	GEBX13	Energy Studies	Mechanical
14.	GE	GEBX14	Robotics	Mechanical
15.	GE	GEBX15	Cyber security	IT
16.	GE	GEBX16	Usability Engineering	CSE
17.	GE	GEBX17	Industrial Safety	Mechanical

SEMESTER I

MAB1181 ALGEBRA, GEOMETRY AND CALCULUS L T P C
3 1 0 4

OBJECTIVES:

The course is aimed at

developing the skills of engineering students in the basics of chosen topics of Mathematics that are imperative for effective understanding of engineering subjects.

laying the foundation for learning further topics of Mathematics in higher semesters in a graded manner.

enabling the learners to appreciate the important role of mathematical concepts in engineering applications.

MODULE I MATRICES 8

Eigenvalue Problems – Eigenvalues and Eigenvectors of a real matrix, Engineering Applications –Properties of Eigenvalues and Eigenvectors – Cayley Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II VECTOR ALGEBRA 6

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl.

MODULE III THREE DIMENSIONAL ANALYTICAL GEOMETRY 8

Direction cosines & ratios – angle between two lines – equations of a plane – equations of a straight line - coplanar lines - shortest distance between skew lines – sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE IV DIFFERENTIAL GEOMETRY 7

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes & evolutes – envelopes – properties of envelopes and evolutes.

MODULE V MULTI-VARIATE FUNCTIONS **8**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobians - Taylor's series expansion – maxima and minima – Lagrange's multiplier method.

MODULE VI ORDINARY DIFFERENTIAL EQUATIONS **8**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined co-efficients, method of variation of parameters.

L – 45; T – 15; Total Hours– 60

TEXT BOOKS:

Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.

Grewal B.S., "Higher Engineering Mathematics" (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES:

Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.

Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.

Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.

Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.

Ramana, B.V, "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.

OUTCOMES:

On completion of the course the students will be able to

solve Eigenvalue and Eigenvector problems

solve three dimensional geometry problems

use differential calculus for solving problems pertaining to engineering applications

ENB1181	ENGLISH	L T P C
		3 0 0 3

OBJECTIVES:

To enable students to use language appropriately and effectively

To help learners improve their vocabulary and to enable them speak fluently and appropriately in different contexts.

To help students develop listening skills for academic and professional purposes

To develop reading comprehension skills and enhance their ability to read official documents.

To develop their creative thinking and practice creative writing.

MODULE I BASIC LANGUAGE SKILLS AND GRAMMAR 4

Conducting a language proficiency test in the language laboratory to assess the use of various parts of speech, vocabulary, phrasal verbs and idiomatic expressions of students.

MODULE II LISTENING 8

Listening to BBC radio plays and VOA special lessons to teach Phonetics, accent and intonation of spoken English

Appreciation and critical review of popular movies like 'My Fair Lady', 'Sound of Music'. (Excerpts from the movies) - Historical/popular speeches made by Winston Churchill, Abraham Lincoln (Gettysberg's Address), Swami Vivekananda.

MODULE III SPEAKING 8

Self introduction – pair work – introducing one another – short conversations – exchanging opinions – agreement /disagreement

Short presentation (extempore speech) based on visuals – Personal narrations

MODULE IV READING 8

Newspaper articles, circular, notices – Note making – vocabulary extension – Critical review of newspaper articles.

Science fiction- Issac Asimov's "The Dead Past"(Abridged version) - Wings of Fire – Creative thinking – retelling a story with different ending; critical appreciation of plot and characters

MODULE V CREATIVE WRITING 8

Writing slogans for Advertisements

Writing descriptive paragraphs based on visuals

MODULE VI ENGLISH FOR ACADEMIC AND BUSINESS PURPOSES 9

English for academic purpose: letters to the editor, letter seeking permission for industrial visit, letter inviting a dignitary for technical symposium

English for Business purpose: Telephone etiquette – telephone conversations – taking and leaving phone messages.

Total Hours: 45

REFERENCES:

Mohan, Krishna, Meera Bannerjee, 'Developing Communication Skills', Macmillan India Ltd. Chennai (2001).

Sen , Leena 'Communication Skills' Prentice Hall, New Delhi (2004).

Rutherford , Andrea J. 'Basic Communication Skills For Technology' Pearson Education Asia (2002).

Grant Taylor, ' English Conversation Practice' Tata Mcgraw Hill , New Delhi (2001)

P.K.Dutt, G. Rajeevan and C.L.N. Prakash, 'A Course in Communication Skills', Cambridge University Press, India (2007).

OUTCOME:

After completion of the course, students will have the ability to communicate correctly and effectively in academic and professional contexts through exposure and practice in LSRW skills.

FRB1181	FRENCH	L T P C
		3 0 0 3

OBJECTIVES:

To improve their proficiency in French language.

To empower them for successful communication in their professional contexts.

DOSSIER 0 FENÊTRE SUR… 7

Contenus –l'alphabet - se présenter – les langues – les nationalités – les nombres de 0 à 60 – les adjectifs de nationalités – les verbes : s'appeler, être.

L'acte de parole

DOSSIER 1 LES UNS, LES AUTRES…. 12

Contenus - Les salutations (formelles et informelles) - les jours de la semaine – Les articles définis – les adjectifs possessifs – la négation (ne…..pas) – les verbes : avoir.

Demander quelque chose – les mois de l'année – les nombres de 70 à 99 – les articles indéfinis – l'adjectif interrogatif (quel, quelle)

Quelques événements culturels – donner des informations personnelles – indiquer ses gouts – l'expression des gouts – les prépositions (les noms de pays).

L'acte de parole

DOSSIER 2 ICI /AILLEURS 12

Contenus – Parler de sa ville – Donner/ Demander des explications – les prépositions de lieu – articles contractés – pourquoi / parce que

Auberges de jeunesse et hôtels – s'informer sur un hébérgement- quelques verbes et indications de direction – quelques formules de politesse.

Le code postal et les départements le libellé d'une adresse en France – Ecrire une carte postale – Dire le temps qu'il fait – les adjectifs démonstratifs - Formules pour commencer / terminer.

L'acte de parole

DOSSIER 3 SOLO OU DUO **14**

Contenus – Les animaux de compagnie les animaux préférés des Français - parler de sa profession – les professions - les activités sportifs - les noms animaux – les verbes : aimer , adorer, détester, faire, aller.

Nouveaux mode de rencontres – caractériser une personne (physique et psychologique) – les adjectifs qualificatifs – les pronoms toniques.

Les sorties – proposer, refuser, accepter une sortie – fixer un rendez-vous – inviter – Donner des instructions – L'impératif : 2e personne – Le pronom on=nous – Les verbes : Pouvoir, vouloir, devoir.

L'acte de parole

L'examen oral

Total Hours : 45

TEXT BOOK:

Alter EGO I – Goyal – Langers (0 – 5 Lessons)

OUTCOMES:

On completion of the course,

The students will be able to deal with their clients effectively at global level.

Their proficiency in French Language will have improved.

ISB1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

To read and write in Arabic language.

To learn vocabulary of different fields

To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.

Listening and Reading.

Audio & Video aided listening, Tajweed listening,

Writing Arabic Alphabets (connected & unconnected).

Introducing words.

Reading simple sentences.

Learning names of the things in and around the class room.

Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs

Communicating Simple sentences.

Jumla' Ismiyya and Jumla' Fi'liyya

Situational Conversation:

Greetings, Introduction.

Classroom, College, Picnic.

Dining and Kitchen.

Reading skills.

Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.

Audio aids.

Writing Simple sentences.

Communicating ordinal and cardinal numbers.

Situational communication:

Playground, library.

Forms of plural – Sample sentences.

Introduction to tenses.

Exercises.

MODULE IV FUNCTIONAL ARABIC **8**

Communication:

Family, travel

Market, Prayer hall

Writing skills:

Note making.

Sequencing of sentences.

Developing answers from the questions.

Exercises.

MODULE V TECHNICAL ARABIC **8**

Importance of technical communication.

Reading and writing skills.

Audio & Video aided listening.

Introduction to Arabic terms related to administration.

Situation communication:

Air travel, Office administration,

passport, visa.

Exercises.

MODULE VI TECHNICAL ARABIC **7**

Situation communication:

Contractual work, machineries and equipments..

Computer, internet browsing. Banking,

Exercises.

Total Hours: 45

TEXT BOOK:

Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

Write correct sentences in Arabic.

Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

PHB1181	PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce basic physics concepts relevant to Engineering and Technology students.

To get familiarize with solving problems in basic physics.

To acquaint applications of physics for Engineering issues.

MODULE I PROPERTIES OF MATTER **7**

Elasticity – Stress strain diagram – Factors affecting elasticity – Twisting couple on a wire – Shaft – Torsion pendulum – Depression on a cantilever – Young's modulus by cantilever – Uniform and non-uniform bending – Viscosity.

MODULE II CRYSTAL PHYSICS **6**

Introduction – Space lattice – unit cell – Bravais lattices – Miller Indices for cubic crystals – Inter planar spacing in cubic lattice – Simple crystal structures – SC, BCC, FCC and HCP structures – Atomic radius, coordination number, Packing factor calculation – Crystal imperfections.

MODULE III QUANTUM PHYSICS **7**

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jeans law from Planck's theory – Compton effect – Theory and experimental verification – Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schroedinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box.

MODULE IV WAVE OPTICS **9**

Interference theory – Air wedge – Michelson interferometer – Diffraction – Fresnel and Fraunhofer diffraction - Polarization – Double refraction – Theory of plane polarized, circularly polarized and elliptically polarized light – Quarter wave plate, Half wave plate – Production and detection of plane, circularly and elliptically polarized lights – Photoelasticity – Photo elastic effect – Stress optic law – Effect of stressed model in a plane polariscope (qualitative) –Photo elastic bench.

MODULE V LASER & FIBRE OPTICS **9**

Principle of spontaneous emission and stimulated emission - Characteristics of laser light -Einstein's A & B coefficients (derivation) – Population inversion - pumping - Nd:YAG laser – CO2 laser – Applications – Material processing and holography (construction and reconstruction of hologram)- Optical fibre – Principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – Types of optical fibers - applications – Fibre optic communication system (block diagram only)- Fibre optic sensors (displacement and pressure sensors (qualitative), Medical endoscope.

MODULE VI ULTROSONICS AND NDT **7**

Ultrasonics – Production – Magnetostriction and piezo electric methods – Properties of ultrasonic waves – Detection of ultrasonic waves – Applications – Ultrasonic interferometer- Acoustical grating – SONAR – Depth of sea – Measurement of velocity of blood flow – Non Destructive Testing (NDT) methods – Ultrasonic flaw detector – A,B & C scanning methods.

Total Hours: 45

TEXT BOOKS:

Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.

Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.

REFERENCES:

Uma Mukherji, "Engineering Physics", Narosa Publishing House, New Delhi, 2007.

Charles Kittel, "Introduction to solid state physics", 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd, 2008.

Avadhanulu M.N., "Engineering Physics", 1st Edition, S.Chand & Company Ltd., New Delhi, 2007.

Schiff, "Quantum Mechanics", 3rd Edition, Tata McGraw-Hill Education, 2010.

Rajendran V. and Marikani A., "Applied Physics for Engineers", 3rd Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2003.

William T. Silfvast, “Laser Fundamentals”, 2nd edition, Cambridge University Press, 2004.

Arumugam M., “Engineering Physics”, 5th Edition, Anuradha Agencies, 2003.

OUTCOMES:

At the end of the course, the students will be able to

Apply the knowledge of properties of matter in Engineering Mechanics and Fluid Dynamics.

Characterize Engineering materials

Use Lasers for Fiber Optics Technology and Material Processing

Do non-destrictive testing using Ultrasonic Techniques

CHB1181	CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make students conversant with the

Water quality for potable and industrial purposes.

Different engineering materials, their physico-chemical properties and specific applications.

Concept of electrochemistry, corrosion and theories of corrosion.

Principles of spectroscopy and applications.

Basic principles of green chemistry and the need for green processes in industries.

MODULE I WATER TECHNOLOGY **8**

Introduction – Impurities present in water – Hardness, Types of Hardness, Estimation of Hardness (EDTA method) (Problems) – Alkalinity, Estimation of Alkalinity – Disadvantages of hard water in industries – Conditioning methods: external treatment method: Ion exchange method – internal treatment: colloidal, phosphate, calgon, carbonate methods – drinking water standards (BIS) – treatment of domestic water: screening, sedimentation, coagulation, filtration, disinfection: by chlorination, UV treatment, ozonization – desalination and reverse osmosis (principle only).

MODULE II ENGINEERING MATERIALS **8**

Abrasives: Moh's scale of hardness – natural abrasives: diamond, corundum, emery, garnets and quartz – artificial abrasives: silicon carbide, boron carbide.

Refractories: characteristics, classification – acidic, basic and neutral refractories, properties – refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling – general method of manufacture of refractories, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Nanomaterials: Definition – types of Nanomaterials; nanofilms, nanowires, carbon nanotubes, quantum dots and fullerenes (C_{60}) – Size and shape dependent optical, electrical, thermal and mechanical properties; Synthesis

of nanomaterials – Top down and bottom up approach; Applications of nanomaterials – Catalysis, Electronics and Telecommunication, Medicines, Composites and Energy.

MODULE III ELECTROCHEMISTRY AND CORROSION 9

Construction of a cell – Standard and single electrode potential – electrochemical series – EMF and its measurement – Nernst equation, application and problems – Types of electrodes: standard hydrogen electrode, calomel electrode, ion selective electrode - glass electrode and determination of pH using glass electrode – polarization, overvoltage, decomposition potential (statements only) – Conductometric and potentiometric titrations.

Corrosion: Definition – Dry corrosion and Wet corrosion with mechanisms – Factors influencing corrosion.

MODULE IV CHEMISTRY OF POLYMERS 6

Monomers – functionality – polymer – degree of polymerization – classification – Polymerization techniques: addition, condensation and co-polymerization with example – mechanism of polymerization: free radical, cationic and anionic mechanism – thermoplastics and thermosetting plastics with examples – compounding and moulding of plastics: injection moulding and compression moulding.

MODULE V SPECTROSCOPY 9

Electromagnetic spectrum – absorption of radiation – electronic, vibrational, translational and rotational – intensities of spectral lines – Beer-Lambert's Law (Problems) – Colorimetric analysis: estimation of concentration of a solution – Flame photometry: theory, instrumentation (block diagram only) and application – UV-Visible spectroscopy: Principles, instrumentation (block diagram only) and simple applications – IR spectroscopy – simple applications only.

MODULE VI GREEN CHEMISTRY 5

Introduction – Significance – Industrial applications of green chemistry; Green technology – Latest green laboratory technique for saving experimental resources and infrastructural framework; Principles of green chemistry – R4M4 model (Reduce, Reuse, Recycle, Redesign; Multipurpose, Multidimensional,

Multitasking, Multi-tracking) – Life cycle analysis technique (cradle to grave approach)

Total Hours: 45

TEXT BOOKS:

Jain P.C and Renuka Jain, 'Physical Chemistry for Engineers', Dhanpat Rai and Sons, New Delhi. (2001).

Paul T. Anastas, John C. Warner, 'Green Chemistry: Theory and Practice', Oxford University Press, (1998).

REFERENCES:

Bahl B.S., Tuli and Arun Bahl, 'Essentials of Physical Chemistry', S. Chand and Company Ltd., New Delhi, (2004).

Kuriacose J.C. and Rajaram J, 'Chemistry in Engineering and Technology', Volume1, Tata McGraw- Hill publishing company, New Delhi, (1996).

Puri B.R., Sharma L.R. and Madan S. Pathania, 'Principles of Physical Chemistry', Shoban Lal Nagin Chand and Co., Jalandhar, (2000).

OUTCOMES:

At the end of the course, students will be able to

estimate the degree of hardness in water; solve related problems and treatment methods for potable water.

select materials for specific engineering applications.

use electrochemistry principles to understand the mechanism of corrosion.

analyze trace quantity of metals using instrumental methods.

realise the need of green practices in industries.

GEB1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	3	3

OBJECTIVES:

To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers

To provide an exposure to the appropriate standards for technical drawings

To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, pictorial views and free hand drawing

To introduce computerized drafting

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola

Special curves: Cycloid, epicycloid, hypocycloid, involutes, helix

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, third angle projection methods, free hand sketching of orthographic views of simple machine parts as per first angle projection. Projection of points. Commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Straight lines in first quadrant – true length and true inclinations, traces – rotating line and trapezoidal methods. Projection of plane lamina in first quadrant – trace of plane.

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids: Axis inclined to one reference plane only - prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **10**

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional views – true shape of sections - solids in simple position and cutting plane inclined to one reference plane only.

Development of surfaces: truncated solids - prism, pyramid, cone, cylinder, frustum of cone and pyramid.

MODULE VI PICTORIAL PROJECTIONS **12**

Isometric projection: isometric scale - isometric projection and view of prism, pyramid, cylinder, cone, frustums and truncated solids.

Perspective projection: prism, pyramid, cylinder, frustums – visual ray and vanishing point methods.

Total Hours: 60

TEXT BOOK:

N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 46th Edition, (2003)

REFERENCES:

K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2006)

Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

Students who complete this course will be able to:

draw various views of engineering components

graphically communicate their concepts and ideas on new designs

SSB1182 SOCIOLOGY, ETHICS AND HUMAN VALUES **L T P C**
3 0 0 3

OBJECTIVES:

To give an overview of the fundamental of sociology.

To expose how society developed in India, classes and impact.

To introduce sociological aspects relating to industry

To provide some basic concepts on ethics and human rights.

To stress the role of engineer to the society, environment and sustainability.

MODULE I FUNDAMENTALS OF SOCIOLOGY **7**

Sociology - definition, evolution – scope – basic concepts – social process, sociological theories, social institutions, culture and social stratification – family – economic – politics – religion – education, state and civil society – social control.

MODULE II SOCIOLOGY IN INDIAN CONTEXT **7**

Development – Institutions, classes – women and society – impact of social laws, social change in contemporary India – secularism and communalism – social exclusion and inclusion.

MODULE III INDUSTRIAL SOCIOLOGY **7**

Definition and perspectives – industry in India – social groups in industry, behaviour pattern – group dynamics – focus groups – team – enhancing group behaviour.

MODULE IV INDUSTRIAL – SOCIETY INTERFACE **8**

Perspectives – social responsibilities – sociological effect on industrialization – urbanization, child labour, psychological impact, Impact of technology, modernization – globalization – challenges – role of engineers.

MODULE V ETHICS AND HUMAN VALUES **8**

Ethics and values – organizational values – personal worth, ethical behavior, professional ethics, whistle blowing, international ethics, corruption.

MODULE VI ENGINEERS AND SOCIETY **8**

Quality of life and society – engineer in economic development, technology development – invention, innovation and diffusion – appropriate technology – engineer's contribution, ecology and environment – sustainability – role of engineers.

Total Hours: 45

REFERENCES:

Samir Das Gupta and Paulomi Saha, An Introduction to Sociology, Pearson, Delhi, 2012.

Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.

Vidya Bhushan and D.R. Sachdeva, Fundamental of Sociology, Pearson, Delhi, 2012.

Deshpande, Satish, Contemporary India : A Sociological view, Viking (2002)

Thopar, Romila, Early India, Penguin (2003).

Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996.

OUTCOMES:

Students will have an exposure to the fundamentals and basic concepts of Sociology.

Students will gain knowledge in Industrial Sociology.

Students will have gained knowledge about the impact of technology, modernization, globalization and their contribution towards society.

PHB1182	PHYSICS LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

To understand the basic concepts of properties of matter, wave optics

To understand the properties of ultrasonic and Laser.

To understand the crystal growth technique.

To correlate the experimental results with the theoretical values.

LIST OF EXPERIMENTS:

Torsional Pendulum- Determination of rigidity modulus of a given wire.

Determination of coefficient of viscosity of a liquid by Poiseuille's method .

Determination of Young's modulus of a beam using non – uniform bending method.

Determination of a thickness of a given wire – Air wedge.

Spectrometer- determination of wavelength of given source by using grating.

Determination of velocity of ultra sonic waves – Ultrasonic Interferometer.

Determination of numerical aperture and acceptance angle of an optical fiber.

Determination of particle size using Laser.

Growth of crystal by slow evaporation technique.

Determination of angle of divergence of Laser beam.

Photo electric effect experiment.

OUTCOMES:

On completion of this course, the student will know

Properties of matter, wave optics and quantum physics

Properties and application of Ultrasonic and Laser

Principle and concept of crystal growth technique.

CHB1182	CHEMISTRY LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

To make students conversant with the

estimation of hardness and TDS in water samples.

Construction of cell and determination of EMF.

Estimation of pH of solutions.

Verification of Beer Lambert's law.

LIST OF EXPERIMENTS:

Estimation of hardness in domestic water.

Estimation of total dissolved solids (TDS) in domestic water

Construction and determination of emf of a cell.

Determination of single electrode potential.

Estimation of strong acid in the industrial effluents

Estimation of Fe^{2+} present in unknown sample – by Potentiometry

Verification of Beer-Lambert's law and estimation of Cu^{2+} present in unknown sample.

Estimation of Na and K present in the agricultural field – by flame photometry.

Study of effect of inhibitors in free radical polymerization (Demo)

OUTCOMES:

At the end of the course, students will be able to

estimate the degree of hardness and TDS in water samples.

construct and calculate EMF of cell.

apply the concept of Beer lamberts law.

GEB1102	BASIC ENGINEERING PRACTICES LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits

To have an understanding on the use of various tools, instruments and methods

To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

Study of plumbing in general household and industrial systems

Making a small window frame with Lap and Mortise & Tenon Joints

MECHANICAL ENGINEERING PRACTICE

Fabrication of a small Table frame with Butt, Lap and Fillet Joints

Machining of a simple component like a table weight using lathe

Mould preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

Comparison of incandescent, Fluorescent, CFL and LED lamps.

Study of Protection Circuits (small relay, fuse, MCB, HRC,MCCB,ECCB).

Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).

Understanding of Domestic and Industrial wiring.

Earthing and its significance.

Troubleshooting in Electrical Circuits.

Study of inverter fed UPS/Emergency lamp.

ELECTRONIC ENGINEERING PRACTICE

Identifications symbolic representation of active and passive electronic components

Solderingand tracing of electronic circuits and checking its continuity

Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project

OUTCOMES:

Students who complete this course

Should be able to appreciate the practical skills needed even in making of simple objects, assemblies and circuits

Should be able to attend minor defects especially in items used in day to day life

Should be aware of the safety aspects involved in using tools and instruments

GEB1103	COMPUTER PROGRAMMING & APPLICATIONS	L T P C 2 0 2 3

OBJECTIVES:

Expose fundamental concepts and techniques in programming

Give coverage on application logic in programming

Focus on solving practical problems based on analyzing, designing, and implementing computer programs

MODULE I FUNDAMENTALS OF COMPUTERS **5**

Evolution – Generations - Classifications – Applications – Computer organization –Hardware in a typical computer Identification - Booting – Booting error messages - Number system - Number system conversions

MODULE II BASIC PROGRAMMING AND DEBUGGING **5**

Software types – Types of Operating systems - Software development steps – Information technology and internet - The programming tool - Structure of a basic program - Hello world program – Debugging it – Character set – Delimiters – Keywords, identifiers – Constants – Variables –- Tools and help features – Comments in a program

MODULE III INPUT AND OUTPUT **5**

Data types - Type conversions - Input/Output: Formatted functions – Unformatted functions – Library functions – Debugging the code – Systems software: Compiler – interpreter- linker – loader - Finding the correct answer given a code snippet and justifying it

MODULE IV PROBLEM SOLVING **5**

Problem solving techniques: Algorithm, flowchart – Pseudo-code – Examples of simple problems in algorithms and flowcharts – Sorting and Searching - Characteristics of a good program – Generations of programming language

MODULE V OPERATORS AND DECISION STATEMENTS **5**

Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators – If –if else- nested if else- goto- switch case – nested

switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement

MODULE VI ARRAYS AND LOOP CONTROL STATEMENTS 5

Arrays – Initialization – Definition – Characteristics – One dimensional array – Two dimensional arrays - Multi dimensional arrays – Predefined streams - Operation with arrays – Sorting and searching – Structures – Operations on structures

LIST OF EXPERIMENTS: 30

Computer organization –Hardware in a typical computer Identification – Booting - error messages and what it means

Types of Operating systems – Windows and Linux

Structure of a basic program - Hello world program – Debugging it

Data types Type conversions

Input/Output: Formatted functions – Unformatted functions – Library functions

Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators

If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement

Arrays – Operation with arrays

Sorting and searching

Total Hours: 60

TEXTBOOKS:

Ashok N Kamthane, “Computer Programming”, 2nd Edition, Pearson Education, 2012.

Paul J. Deitel, Deitel & Associates, “C How to Program”, 7th Edition, Pearson, Education, 2012.

OUTCOMES:

Students who complete this course will be able to:

Understand Modular design, logic flow, data abstraction

Describe basic programming constructs, functions, and I/O.

Write down programs for sorting and searching algorithms

Write down programmes developing cycle for different applications

The students will be able to debug the programs while solving some practical problems in programming

SEMESTER II

MAB1282 ADVANCED CALCULUS L T P C

3 1 0 4

OBJECTIVE:

The aim of the course is to

train the students in additional areas of Engineering Mathematics, necessary for grooming them into successful engineers. The topics will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.

MODULE I DOUBLE INTEGRALS 7

Double integration – Cartesian and Polar coordinates – change of order of integration – area as a double integral — change of variables between Cartesian and polar coordinates.

MODULE II TRIPLE INTEGRALS AND SPECIAL FUNCTIONS 7

Triple integration in Cartesian coordinates - change of variables between cartesian, cylindrical and spherical polar coordinates - Beta and Gamma functions.

MODULE III VECTOR INTEGRATION 7

Line, surface and volume integrals – Green's, Gauss Divergence and Stoke's theorems (without proof) – verification and evaluation of integrals using them.

MODULE IV ANALYTIC FUNCTION 8

Analytic function - Necessary and Sufficient condition (Proof not included) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE V COMPLEX INTEGRATION 8

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

MODULE VI PARTIAL DIFFERENTIAL EQUATIONS 8

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

L – 45; T – 15; Total Hours- 60

TEXT BOOKS:

Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.

Grewal B.S., "Higher Engineering Mathematics" (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES:

Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.

Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.

Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.

Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.

Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.

OUTCOMES:

On completion of the course the students will be able to

solve integrals of higher orders.

apply vector calculus for solving engineering problems.

solve complex differentiation and integration problems related to engineering.

formulate practical problems in terms of partial differential equations, solve them and physically interpret the results.

PHB1283 PHYSICS OF ENGINEERING MATERIALS L T P C
(Common to ECE, EEE, AERO, CSE & IT Branches) 3 0 0 3

OBJECTIVE:

To familiarize the physical, chemical, electrical and mechanical properties of different Engineering materials.

MODULE I CONDUCTING MATERIALS 10

Electron ballistics : charged particle, force on charged particles in an electric field, force on charged particles in Magnetic field - Parallel electric and magnetic field - Perpendicular electric and magnetic field - Classical free electron theory of metals – Derivation for electrical conductivity – Merits and drawbacks of classical theory – Quantum free electron theory of metals and its importance (qualitative) – Energy distribution of electrons in metals – Fermi distribution function – Density of energy states and carrier concentration in metals (derivation) – Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of band theory.

MODULE II SEMICONDUCTING MATERIALS 9

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors –Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE III DIELECTRIC MATERIALS 7

Dielectric constant – Electric Susceptibility – Types of dielectric polarization – Frequency and temperature dependence of polarization – Internal field and deduction of Clausius-Mosotti's equation(derivation) – Dielectric loss – Types of dielectric breakdown – Uses of dielectric materials (capacitor & transformer).

MODULE IV MAGNETIC MATERIALS 6

Origin of magnetic moment –Types of magnetic materials and their properties – Ferromagnetism – Domain theory of ferromagnetism, hysteresis, soft and

hard magnetic materials – Anti ferromagnetic materials (qualitative) – Ferrites – Applications-Magnetic memory – Tapes & magnetic disk drives.

MODULE V SUPERCONDUCTING MATERIALS 6

Superconductivity - BCS theory - Meissner effect - Critical magnetic field - Type I and type II superconductors - High temperature superconductors - Applications of superconductors: SQUID and magnetic levitation.

MODULE VI OPTICAL AND NEW ENGINEERING MATERIALS 7

Optical properties of semiconductors – Direct and indirect bandgap semiconductors – Color centers, exciton – Luminescence – Fluorescence – Phosphorescence – Liquid crystal display, Solar cell – Electro optic effect-Pockel's effect - Kerr effect – Faraday effect. Metallic glasses – Preparation, properties and applications - Shape Memory Alloys – Preparation, properties and applications, Nano phase materials – Synthesis, properties and applications.

Total Hours: 45

TEXT BOOKS:

Palanisamy P.K., Physics II, Material Science for ECE, Scitech Publications (India) Pvt Ltd., 2006.

Safa O. Kasap, Principles of Electronic materials and devices, McGraw Hill Publishers, 3rd Edition, 2006.

REFERENCES:

Arumugam.M, Physics II, Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.

Jacob Millman, Christos C.Halkais, Electronic Devices and Circuits, Tata McGraw-Hill, New Delhi, 1991.

Charles Kittel, Introduction to solid state physics, 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd.

Sze. S.M., Semiconductor Devices – Physics and Technology, 2nd edn. John Wiley, 2002.

Nandita Das Gupta and Amitava Das Gupta, Semiconductor Devices – Modelling and Technology, Prentice Hall of India, 2004.

Donald A. Neamen, “Semiconductor Physics and Devices” 3rd Edition, Tata McGraw Hill, 2002.

OUTCOMES:

On completion of this course, the student will be able to

choose the correct semi-conductors for electronic devices and display.

use dielectric materials for transformers and capacitors

use ferromagnetic materials for solid state devices

apply the concept of super conductivity for Engineering applications.

SSB1181	INTRODUCTION TO ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

Primarily to give an overview of fundamentals of economics to the engineering students

In particular

To introduce the basic concepts of demand, supply and equilibrium.

To familiarize on National Income concepts.

To provide fundamental concepts of money, banking and exchange.

To give an idea on industrial sector, markets and trade.

To give an overview on five year plans, budget, policies and taxation.

To provide an overview of Indian economy and the role of engineers in economic development.

MODULE I INTRODUCTION **8**

Classification of economy – open and closed economy – sectors of economy – Basic principles of micro economics – supply ,demand and equilibrium, elasticity of demand- pricing models.

MODULE II NATIONAL INCOME DETERMINATION **7**

National Income concepts – GNP, GDP, disposable Income; Aggregate demand and Aggregate supply, macroeconomic equilibrium - concepts of MPS, APS, MPC APC, Inflation – prices indices WPI, CPI and Inflation control.

MODULE III MONEY AND BANKING **7**

Monetary system - Role of Central Bank – Monetary policy – Commercial banks, Development banks; Money market – the role of money.

MODULE IV INDUSTRY, MARKET AND TRADE **7**

Public and private sectors – Contribution to the national economy, Industrial policy. Markets – labor, capital and debt market. Trade: domestic and International trade.

MODULE V BUDGET, POLICIES AND INDICATORS 8

Economic development – Five year plans, Macro-economic indicators; Central budget: Government revenue-tax and non-tax revenue, government expenditures-plan and non-plan expenditures – Fiscal policy – The impact of the budget on the economy.

MODULE VI ECONOMIC GROWTH AND THE ROLE OF ENGINEERS 8

India Economy – the role of market in the Indian economy – Development in the post independence era – Growth of the economy, Globalization and liberalization – reforms made and their effects, challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

Total Hours : 45

REFERENCES:

Vanitha Agarwal, 'Macroeconomics: Theory and Practice', Pearson, (2010).

Dwivedi D.N, 'Macroeconomics: Theory and Policies', 3rd edn; McGraw Hill, (2010).

Samuelson,Paul A., 'Macroeconomics', 19th edn., TMH, (2009).

Gupta G.S, 'Macroeconomics: Theory and Applications', 3rd edn; TMH, (2007).

OUTCOMES:

Students will have an exposure to the basic concepts of microeconomics and macroeconomics.

Students will have gained knowledge in government budget, economic planning and its implementation, money, banking and trade.

They will have learnt about the economic reforms introduced in Indian economy and the role of engineers towards the economic growth and development of the country.

GEB1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving

To acquaint with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium

To give an exposure on inertial properties of surfaces and solids

To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS 7

Introduction - Units and Dimensions - Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics -Coplanar Forces – Resolution and Composition of forces-Equilibrium of a particle

MODULE II EQUILIBRIUM OF PARTICLE 6

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY 6

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

MODULE IV PROPERTIES OF SURFACES 8

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia.

MODULE V LAWS OF MOTION **10**

Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

MODULE VI FRICTION **8**

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

Total Hours: 45

REFERENCES:

Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.

Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.

Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students:

should be able to resolve forces, moments and solve problems using various principles and laws

should be able to understand the concept of equilibrium, kinetics and kinematics and capable of formulating the governing equations to practical problems and provide solutions for those equations

AEB1211	FLUID MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

To understand the structure and the properties of fluids.

To understand and appreciate the complexities involved in solving the fluid flow problems.

To understand the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.

MODULE I FLUID PROPERTIES AND CLASSIFICATION 9

Introduction - Definitions, units and dimensions, Mass density, Specific Volume, Specific Weight Relative density, Viscosity, Newton's law of viscosity, Compressibility, Vapor pressure, surface tension, Capillarity, Center of pressure, Thermodynamics properties of fluid, Types of fluid.

MODULE II FLUID STATICS AND PRESSURE MEASURING DEVICES 10

Fluid statics: concept of fluid static pressure, hydrostatic pressure distribution, hydrostatic forces on plane and curved surfaces, Buoyancy and stability, Pressure ;absolute and gauge pressures - pressure measuring devices, different types of manometers and pressure gauges.

MODULE III KINEMATICS OF FLUID AND GOVERNING EQUATIONS 10

Lagrangian and Eulerian approaches- Acceleration field, material derivative, concept of control volume, control surface, fundamentals of flow visualization, and types of flow. Governing equations; The differential equation of mass conservation, The differential equation of linear and angular momentum, The differential equation of energy, Boundary conditions of basic equations stream function, vorticity and irrotationality, Frictionless irrotational flow.

MODULE IV VISCOUS FLOW 12

Reynolds number regimes, Internal versus external viscous flow, Head loss-friction factor, Laminar fully developed pipe flow, turbulent modeling, turbulent pipe flow, flow in non circular ducts, and minor losses in pipe system, fluid meters.

MODULE V DIMENSIONAL ANALYSIS AND FLOW PAST IMMERSED BODIES **9**

Dimensional homogeneity, dimensional analysis and similarity Buckingham pi theorem. Reynolds number and geometry effects, momentum integral estimation, the boundary layer equations, the flat- plate boundary, boundary layer with pressure gradient, experimental external flows.

MODULE VI TURBOMECHINERY **10**

Introduction and classification; The centrifugal pumps- performance curve and matching pump to piping system, pump cavitations and net positive suction head, pump in series and parallel, dynamic pump centrifugal pump and axial pump. Turbine; positive- displacement turbine, dynamic turbine, impulse turbine, Reaction turbine, turbine scaling laws.

Total Hours: 60

TEXT BOOK:

Yunus A.Cengel and John M. Cimbala, “Fluid mechanics”, McGraw Hill 2006.

REFERENCES:

Frank M. White, “Fluid mechanics”, Tata McGraw Hill 2008.

Ira M. Cohen and P. K. Kundu, “Fluid Mechanics”, Academic Press, 2002.

OUTCOMES:

Students will be able to

- Identify and relate the properties of fluids.
- Apply the concept of fluid static pressure.
- Apply governing equations of fluid mechanics to fluid flow problems.
- Evaluate losses in pipe flow systems.
- Use dimensional analysis for better planning of experiments.
- Apply the knowledge of pumps and turbines to basic problems in fluid machinery.

AEB1212	INTRODUCTION TO AERONAUTICAL ENGINEERING	L T P C 3 0 0 3

OBJECTIVE:

To introduce the overview of Aeronautical Engineering covering various disciplines including aerodynamics, propulsion, performance, stability & control, materials and structures.

MODULE I AVIATION HISTORY AND AIRPLANE ANATOMY 8

Ornithopters, Lighter-than-Air Craft, Heavier- than-Air Craft , Wright Brothers and their flyer , Developments during and after the World Wars I and II , Developments in Jet transport, Developments in military aviation, Airplane configurations, components of airplanes, functions.

MODULE II BASIC AERODYNAMICS 10

Standard Atmosphere, Aerodynamics forces and Moments, Air speed, Mach Number, Reynold's Number, Dimensional analysis, Aerofoil Aerodynamics, Wing Aerodynamics and Drag Polar.

MODULE III PROPULSION 7

Production of thrust - Propeller Momentum theory, Jet Momentum; Types of engines, Engine components, Specific fuel consumption, Power.

MODULE IV AIRPLANE PERFORMANCE, STABILITY & CONTROL 7

Coordinate systems, Equations of motion, degrees of freedom, pitch, roll ,yaw, rate of climb, absolute & service ceiling, Range, maximum endurance, glide, descent, landing, payload, Principles of stability and control.

MODULE V AIRCRAFT MATERIALS AND STRUCTURES 7

Development of aircraft structures, Stress, strain, stress-strain diagram, Monocoque and semi-monocoque structures – Wing, fuselage, importance of fatigue, Materials used in aircraft.

MODULE VI AIRCRAFT INSTRUMENTS AND SYSTEMS 6

Air data instruments, Gyro instruments, Fly-by-wire system, ILS, Auto-Pilot, CVR, Flight data recorder.

Total Hours: 45

TEXT BOOKS:

Anderson, J.D., “Introduction to Flight”, McGraw-Hill, 1995.

Richard S. Shevell, Fundamentals of Flight, Pearson Education, 2006.

REFERENCES:

Kermode, A. C., Flight without formulae, McGraw-Hill, 1997

B. W. McCormick, Aerodynamics, Aeronautics and Flight Mechanics, John Wiley & Sons, 1995.

OUTCOMES:

Students will be able to

- Identify and relate various components of aircraft and their functions.
- Identify aerodynamic forces on airplanes and their effects on aircraft structures.
- Differentiate between various types of engines and the need for thrust.
- Solve basic problems on aircraft motion and control.
- Identify different structural elements and materials used in aircraft.
- Gain knowledge about the instruments and systems required for the safe operation of airplanes.

ENB1282 WRITTEN COMMUNICATION L T P C

0 0 2 1

OBJECTIVES:

To develop their creative thinking skills and write reviews.

To train them with the nuances of corporate correspondence.

To train them in writing official letters, technical reports and proposals.

To expose them to the writing of Statement of Purpose.

MODULE I WRITTEN COMMUNICATION 4

Introduction - process of writing – ABC of academic and professional writing – Writing an article.

MODULE II CREATIVE WRITING 5

Writing stories based on visuals - Preparing an outline for a story - Writing critical reviews on an article / a paper

MODULE III CORPORATE CORRESPONDENCE 3

Tone in formal writing – e-mail writing, memo, fax, agenda and minutes writing.

Lab: viewing e-mail etiquette, format and conventions of writing memo.

MODULE IV OFFICIAL LETTERS 6

Writing Statement of purpose, Letter of Application and Resume – Assessing one's strengths and weaknesses – peer evaluation.

Lab: Resume writing – Viewing different types – Functional, Chronological - Writing one's resume using wiki, Letter calling for interview and seeking promotion.

MODULE V TECHNICAL WRITING I 6

Describing an experiment, writing instructions and recommendations, Feasibility report and progress report, Synopsis – Group assignment – case study.

MODULE VI TECHNICAL WRITING II **6**

Writing a technical proposal – Format – cover page, executive summary, timeline chart, budget estimate, drafting, conclusion,.

Total Hours: 30

REFERENCES:

Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.

Gerson, Sharon & Steven M. Gerson, 'Technical Writing: Process and Product' Pearson Education, New Delhi. 2004.

M Ashraf Rizvi 'Effective Technical Communication'. Tata McGraw-Hill Education, 2005.

Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing". Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002.

Anderson, Durston & Pool. "Thesis and Assignment Writing". 4th Edition. John Wiley & Sons. Australia. 2002.

OUTCOME:

On completion of the course, the students will have the ability to write all kinds of formal correspondence like letters, reports and proposals.

AEB1213	FLUID MECHANICS LAB	L T P C 0 0 2 1

OBJECTIVE:

This course introduces fluid mechanics applications and measurements to engineering students.

LIST OF EXPERIMENTS:

Comparison of coefficient of discharge of given Orifice meter and Venturimeter.

Calibration of Rotameter

Determination of friction factor for the given set of pipes.

Performance study of Centrifugal pump / Submersible pump

Determination of maximum efficiency for the given Reciprocating pump.

Characteristic curves of Gear pump / Vane pump

Determination of the maximum power at constant speed / constant load for an Impulse turbine.

Performance characteristics of Reaction turbine.

Impact of jet on flat and curved vanes

Verification of Bernoullis equation

Performance test on a jet pump.

Total Hours: 45

OUTCOMES:

On completing this course the student will be able to:

Measure fluid flow through ducts and in open channels, selecting appropriate methods of measurements.

Conduct designed experiments, and analyze and evaluate data.

Apply dimensional analysis techniques in fluid mechanics problems.

Evaluate the performance of centrifugal pumps, turbines and compressors.

PHB1284 PHYSICS OF ENGINEERING MATERIALS LAB L T P C
(Common to ECE, EEE, AERO, CSE & IT Branches) 0 0 2 1

OBJECTIVE:

To study the characteristics of conducting, semiconducting, dielectric, magnetic and optical materials.

LIST OF EXPERIMENTS:

Determination of magnetic field along the axis of a circular coil – Stewart and Gees experiment.

Determination of electrical conductivity of a given metal by four point probe method.

Determination of Hall coefficient of a given semiconductor material.

Determination of band gap of a semiconductor diode.

Determination of dielectric loss of a dielectric material using LCR bridge method.

Determination of time constant of an RC circuit by charging and discharging of a capacitor.

Determination of magnetic susceptibility of a paramagnetic material using Quincke's method.

Determination of energy loss of a given transformer coil using Hysteresis – B-H curve.

Determination of Verdet constant of a material using Faraday Effect.

Determination of Kerr constant using electro optic modulators.

OUTCOMES:

At the end of the course, the student will be able to

Know the properties of conducting, semiconducting, dielectric and magnetic materials.

Know the principle and working of Kerr modulator and Faraday rotator.

SEMESTER III

MAB 2181 TRANSFORMS AND APPLICATIONS L T P C
(Common to all B.Tech Programmes) 3 1 0 4

OBJECTIVES:

The course aims to

develop the skills of the students in the areas of boundary value problems and transform techniques .

acquire knowledge on different transforms like Laplace Transform, Fourier Transform and Z Transform.

MODULE I LAPLACE TRANSFORM 8

Laplace transform – sufficient condition – Transforms of elementary functions-Properties – Transforms of Derivatives and Integrals – Initial and Final Value Theorem - Transform of Periodic functions - Inverse transforms - Convolution Theorem.

MODULE II FOURIER SERIES 7

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

MODULE III BOUNDARY VALUE PROBLEMS 8

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

MODULE IV FOURIER TRANSFORM 7

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

MODULE V Z -TRANSFORM AND DIFFERENCE EQUATIONS 7

Z-transform - properties – Inverse Z–transform – Convolution theorem - Formation of difference equations.

MODULE VI APPLICATIONS OF TRANSFORMS **8**

Applications of Laplace Transform in solving linear ordinary differential equations Second order with constant coefficients, Simultaneous First order equations – Applications of Z–transform in solving difference equations using Z–transform.

Total Hours : 60

TEXT BOOKS:

Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.

Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.

REFERENCES:

Kreyszig .E., “Advanced Engineering Mathematics“ , 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.

Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th edition, Cengage Learning, 2011.

Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.

Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

Ramana B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

OUTCOMES:

Students will be able to

solve Enginering problems in the area of heat conduction, communication systems, electro-optics and electromagnetic theory using different Transforms.

solve Boundary value problems encountered in engineering practices.

LSB2181	BIOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aim of the course is to introduce basic biological concepts to the engineering students to
promote cross-breeding of ideas. In particular,

To provide an overview of cell structure and function.

To give basic idea on biochemistry related to biological aspects.

To introduce genes, their structure, inheritance and about living organisms.

To give an understanding on metabolism, respiration, etc.

To inform students of engineering about the interface of biology and engineering.

MODULE I BASICS OF CELL STRUCTURE AND FUNCTION 7

Cells as unit of life – basic chemistry of cell – physical and chemical principles involved in maintenance of life processes, cell structure and functions – Prokaryotic and Eukaryotic cells, cell wall, plasma membrane, endoplasmic reticulum, nucleus, chromosomes- cell division – mitosis, meiosis – molecules controlling cell cycle.

MODULE II BIOCHEMISTRY 8

Biomolecules – introduction – basic principles of organic chemistry, types of functional groups, chemical nature, pH and biological buffers – carbohydrates-mono, di, oligo and polysaccharides, lipids- phospholipids, glycolipids, sphinglipids, cholesterol, steroids, prostaglandms – aminoacids, peptides, proteins – structures- primary, secondary, tertiary and quaternary, glycoproteins, lipoproteins – Nucleic acids – purines, pyrimidines, nucleoside, nucleotide, RNA, DNA.

MODULE III GENETICS 7

Genes – structure and functions – behavior, dominance and epigenetics, evolution – inheritance – reproduction and gene distribution – genome of living organisms – plants – bacteria and viruses – animals – humans, genetic engineering.

MODULE IV MICROBIOLOGY AND SENSORS **8**

Microbiology – basis of microbial existence – microbial diversity – classification and nomenclature of micro-organisms- impact of microorganisms on industry, agriculture and health, industrial microbiology – primary and secondary screening of micro-organisms, fermentation processes, bioreactors, microbial ecology – microbial bio-remediation – epidemiology and public health.

MODULE V METABOLISM **7**

Metabolic processes – bio-membranes, diffusion, absorption, osmo-regulation, photosynthesis, respiration, dialysis, nutrition, digestion and excretion.

MODULE VI BIOLOGY AND ENGINEERS **8**

Application of biology in engineering– living things as the solutions (bionics) – living things as models (biometrics) – bio-technology – biomedical engineering – effect of human action on living things – right balance – bioinformatics – bionanotechnology – sensors, biosensors, biochips-ethics in biology.

Total Hours : 45

REFERENCES:

Johnson, Arthur T., “Biology for Engineers”, CRC Press, FL, 2011.

Campbell and Recee, “Biology”, 8th edition, Pearson, Benjamin Cummins Pub., 2008.

Scott Freeman, “Biological Sciences”, Printice Hall, 2002

OUTCOMES:

Able to understand the engineering of life processes.

Capable of pursuing tissue engineering, biomedical engineering and biotechnology at master level programme.

Able to apply the knowledge of biology for engineering applications.

Able to understand the engineering of life processes.

AEB2101 **SOLID MECHANICS** **L T P C**
3 1 0 4

OBJECTIVES:

To give brief descriptions on the behavior of materials due to axial, bending, and torsional loads and predicting the failure of materials using the failure theories.

MODULE I AXIAL LOADING **9**

Stress and Strain, Hooke's law, Stress- Strain Diagrams for different engg., Materials, elastic constants, thermal stresses, problems on bars.

MODULE II BEAMS **12**

Statically determinate and indeterminate beams, Shear Force diagrams and Bending moment diagrams for beams (double integration method, Macauly's methods, Moment Area Method, Conjugate Beam Method), principle of superposition.

MODULE III STRESSES IN BEAMS **12**

Bending Stress in symmetrical sections, Constant Strength Beam, composite beams,Principle Stress and Strains, Mohr's circle.

MODULE IV TORSION –SPRINGS – COLUMNS **10**

Torsion of solid and hollow circular shaft, Shear Stress variation, Power transmissions in shaft, open and closed coil helical springs, Stresses in helical springs, Euler's Column curve, Columns with different end conditions.

MODULE V STRAIN ENERGY **8**

Strain energy due to gradual loading(axial, bending, torsion, Shear),impact loading

MODULE VI FAILURE THEORIES **9**

Maximum principle Stress theory, Maximum principle Strain theory, shear stress theory, distortion energy theory, octahedral shear stress theory.

Total Hours: 60

TEXT BOOKS:

James M Gere & Barry J. Goodno, “Mechanics of Materials”, 7th Edition, Cenage Learning, 2009.

R.K.Rajput, “Strenth of Materials:Mechanics of Solid”, 4th edition, S.Chand Limited, 2007

REFERENCES:

- C.T. Sun, “Mechanics of Aircraft Structures”, 2nd Edition, John Wiley & Sons. 2006.
- R.C. Hibbeler, “Structural Analysis”, 5th Edition, Prentice-Hall, 2002.
- B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, “Mechanics of Materials”, Firewall media, 2002.
- Craig, R.R., 1996, “Mechanics of Materials”, John Wiley & Sons, New York.
- R.S.Khurmi, “Strength of Materials”, Twenty third Edition, S.Chand Limited, 2007

OUTCOMES:

The students will be able to

- Predict the behaviour of bars under various loadings.
- Calculate the stress and the deflection of beams under various loadings.
- Give a theoretical design of shaft for the required working conditions.
- Obtain theoretical predictions of the response of the springs and columns subjected to various loads.
- Obtain theoretical predictions of the response of different structural members using strain energy.
- Acquire knowledge on failure theories and predict the failure of structures.

AEB2102 ENGINEERING THEROMODYNAMICS L T P C
3 1 0 4

OBJECTIVE:

To provide an introduction to the laws of thermodynamics, engine cycles, vapour cycles and their applications. The course will also serve as a foundation for Aircraft propulsion.

MODULE I FUNDAMENTAL CONCEPTS 10

History and relevance of thermodynamics to engineering applications, Basic concepts: Property, system-boundary and surroundings, property, state, equilibrium and state postulate, process, path and cycle, Zeroth law of Thermodynamics, Properties of pure substances: Phase equilibrium. Thermal equation of state, Ideal Gas laws, Property Tables. Work transfer, Heat transfer– Modes of heat transfer.

MODULE II FIRST LAW OF THERMODYNAMICS 10

First law – Classical formulation of first law- concept of energy and its various forms, internal energy, enthalpy, specific heats at constant pressure and volume– Tables of enthalpy & Energy – First Law of thermodynamics for closed systems and open systems – Steady flow energy equation – Examples of steady flow processes.

MODULE III SECOND LAW OF THERMODYNAMICS 11

Statements of second law –Thermal reservoir, Heat engines, refrigerators and Heat pumps, Reversible and irreversible process, Absolute temperature, Clausius inequality. Concept of Entropy- increase of entropy principle, second law in terms of entropy, absolute entropy - isentropic process, Tds relations - Perpetual motion machines. Carnot cycle, Exergy, availability and second law efficiency.

MODULE IV THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 8

Thermodynamics property relations, application of continuity and energy equations, Properties of gas and Vapour mixtures - Properties of Steam, simple jet propulsion system.

MODULE V GAS AND VAPOUR POWER CYCLES **13**

Ideal and Real cycles - Otto, Diesel, Dual, Rankine, Brayton, Stirling and Ericsson cycles –Principle of Refrigeration – Vapour compression – Vapour absorption types – Coefficient of performance, Properties of refrigerants, Principle of Air conditioning – Heat pumps.

MODULE VI AIR COMPRESSORS **8**

Classification and working principle, work of compression with and without clearance, Isothermal and Insentropic efficieny of reciprocation air compressors, multistage compression and intercooling. Various typres of compressors (descriptive treatment only)

Total Hours: 60

TEXT BOOKS:

Yunus A. Cengal, “Thermodynamics an Engineering Approach”, 3rd Edition, Tata McGraw-Hill Co. Ltd., 2002.

Nag P. K., “Engineering Thermodynamics”, 7th Edition, Tata McGraw-Hills Co., Ltd., 1993.

REFERENCES:

Mayhew, A. and Rogers, B., “Engineering Thermodynamics”, E.L.B.S. Edition, Longman Green & Co. Ltd., London, 1990.

Saad, M.A., “Thermodynamics for Engineers”, Prentice-Hall of India Pvt. Ltd., 1989.

Reynolds, “Thermodynamics”, Int. Student Edition, McGraw-Hill Book Co., Ltd., 1990

Kroes Michael J; Wild Thomas W, “Aircraft Powerplants” 7th Edition, Tata McGraw-Hill, 2007.

Hill Philip, Peterson Carl, “Mechanics and Thermodynamics of Propulsion”, Addison Wesly, 1992.

J.D.Mattingly, “Elements of Propulsion - Gas Turbines and Rockets”, AIAA Education series, 2006.

OUTCOMES:

Students will be able to

- Identify and relate various properties and thermodynamic system.
- Apply an appropriate formulation of the first law to relate energy, heat and work.
- Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
- Apply the governing equations.
- Employ temperature-entropy diagrams to analyze the gas and vapour power cycles.
- Determine work input for an air compressor with a given set of operating parameters.

AEB2103	INTRODUCTION TO MANUFACTURING PROCESSES	L T P C 3 0 0 3

OBJECTIVES:

To learn the basic operations of various manufacturing processes.

MODULE I CASTING **7**

Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes – CO_2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

MODULE II WELDING **8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

MODULE III MACHINING **8**

General principles of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines, General principles and applications of processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

MODULE IV FORMING AND SHAPING OF PLASTICS **7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

MODULE V METAL FORMING AND POWDER METALLURGY 9

Principles and applications of the processes- Forging, Rolling, Extrusion, Wire drawing and pinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

MODULE VI SHEET METAL PROCESSESS 6

Sheet metal characteristics- Typical shear operation, bending and drawing operations- Stretch forming operations- Formability of sheet metal- Test methods- Application to Aircraft panels

Total Hours: 60

TEXT BOOKS:

Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.

Nagendra Parashar B.S. and Mittal R.K., “Elements of Manufacturing Processes”,Prentice-Hall of India Private Limited, 2007.

REFERENCES:

Serope Kalpajian, Steven R.Schmid, “Manufacturing Processes for Engineering Materials”, 4th Edition, Pearson Education, Inc. 2007.

R.K.Jain and S.C. Gupta, “Production Technology”, 16th Edition, Khanna Publishers,2001.

“H.M.T. Production Technology – Handbook”, Tata McGraw-Hill, 2000.

Roy. A. Linberg, “Process and Materials of Manufacture”, PHI, 2000.

M. Adithan and A.B. Gupta, “Manufacturing Technology”, New Age, 2006.

OUTCOMES:

Students will be able to

- Differentiate various moulding techniques and their uniqueness.
- Identify machining processes for the manufacture of products/components.
- Identify different welding techniques for joining various metals.
- Acquire knowledge on forming and shaping of plastics followed in industries.
- Acquire knowledge on powder metallurgy processes.
- Select appropriate sheet metal processes for aircraft panels.

AEB 2104 LOW SPEED AERODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

To introduce the basic aerodynamic concepts like circulation, vorticity and irrotationality.

To understand the concepts of superposition of elementary flows for linear incompressible flow.

To introduce the concept of classical thin airfoil theory and Prandtl's lifting line theory for wings.

Introduce the basics of viscous flow.

MODULE I FUNDAMENTAL EQUATIONS OF AERODYNAMICS 6

Continuity, momentum and energy equations, Differential equations for streamline, angular velocity, Vortices, circulation. Stream Function, Potential Function, Equi-potential Lines, Elementary Flows and their combinations.

MODULE II FUNDAMENTALS OF INVISCID INCOMPRESSIBLE FLOW 8

Bernoulli's equation, incompressible flow in a duct, pitot tube, pressure coefficient, governing equation for irrotational incompressible flow, elementary flow, ideal Flow over a circular cylinder, D'Alembert's Paradox, lifting flow over a cylinder, Kutta Jonkowski Theorem, Real flow over smooth and rough cylinder, method of source panels.

MODULE III INCOMPRESSIBLE FLOW OVER AIRFOILS 9

Airfoil nomenclature, airfoil characteristics, Kutta condition, circulation and vorticity, circulation and lift, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications, vortex panel method.

MODULE IV INCOMPRESSIBLE FLOW OVER FINITE WINGS 10

Downwash and induced drag, Vortex Filament, Biot-Savart Law, Helmholtz theorems, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Prandtl's Lifting Line Theory, lift and induced drag coefficients for elliptic lift distribution, effect of aspect ratio, non-linear lifting-line method, lifting surface theory, vortex lattice method.

MODULE V INCOMPRESSIBLE LAMINAR BOUNDARY LAYER 6

Laminar incompressible boundary layer, boundary layer equations, flat plate boundary layer, Blasius solution, effect of pressure gradient, similarity in boundary layer, Karman Integral relation, laminar separation.

MODULE VI TURBULENT BOUNDARY LAYER 6

Turbulent boundary layer on a flat plate, effect of pressure gradient, Prandtl's mixing length hypothesis, free shear layers.

Total Hours: 45

TEXT BOOKS:

John D. Anderson, Jr., Fundamentals of Aerodynamics, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007.

H. Schlitching, Boundary Layer Theory, 7th Edition, McGraw-Hill Book Company, New York, 1979.

REFERENCES:

Houghton, E.L., and Caruthers, N.B., Aerodynamics for Engineering students, Edward Arnold Publishers Ltd., London, 1989.

Katz and Plotkin, Low Speed Aerodynamics, Cambridge Univ. Press, 2002.

Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985

John J Bertin., Aerodynamics for Engineers, Pearson Education Inc, 2002

OUTCOMES:

Students will be able to

- Mathematically express the fundamental equations of fluid flow and elementary flow concepts.
- Apply potential flow theory for inviscid, incompressible flow.
- Perform simple calculations for the estimation of the lift characteristics of airfoils using circulation theory/ thin airfoil theory.
- Estimate the induced drag characteristics and lift characteristics of finite wings.
- Perform simple laminar boundary layer calculations.
- Perform simple calculations in wall bounded turbulent boundary layer/ free shear layers.

ENB 2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

To help the students acquire efficiency in Spoken English with due importance to Stress, Accent and Pronunciation.

To hone the listening skills and understand native accent.

To enable them to make presentations effectively.

To develop their ability to persuade and convince people to accept a point of view.

To prepare them for Placement Interviews, Group discussions etc.

MODULE I **8**

Oral Communication – Implications in real life and work place situations

One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking

Prepared presentations and extempore presentations

Group project – presentation on any social issue. The group will have to research on the history of the problem, its cause, impact and outcome hoped for and then make a presentation

Recording presentations and feedback - Peer and faculty evaluation

MODULE II **2**

Listening to ESL Podcast – Viewing Multimedia – Listening to BBC News - Received Pronunciation (RP)/ VOA/ NDTV – exposure to paralinguistic features.

MODULE III **4**

Developing persuasive skills - Selling a product – marketing skills – the topics will be on advertising, convincing some one on social issues such as preservation of water, fuel, protection of environment, gender discrimination.

MODULE IV **4**

Debates on pros and cons on topics of relevance like Nuclear Energy, Appropriate Technology, Internet, Social Media. This will be followed by Peer and Faculty feedback.

MODULE V **6**

Brainstorming – Think, pair and share activity – Discussion etiquette – Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter) Peer and faculty feedback

MODULE VI **6**

Interview Skills - Assessing one's strengths and weaknesses, SWOC Analysis, Mock interview – Verbal and Non-verbal Communication – Types of Job Interview – Telephone Interview, Stress Interview.

Total Hours: 30

REFERENCES:

Hancock,Mark. "English Pronunciation in Use". Cambridge University Press, UK. 2005.

Anderson, Kenneth & et.al. "Study Speaking : A Course in Spoken English for Academic Purposes", Second Edition, Cambridge University Press, UK. 2004.

Hurlock, B. Elizabeth. "Personality Development". Tata McGraw Hill, New York. 2004.

OUTCOME:

On completion of the course, the students will have the ability to speak confidently and effectively in Presentations and Group Discussions.

AEB2105	SOLID MECHANICS LAB	L T P C 0 0 3 1

OBJECTIVES:

To provide training in testing and evaluation of mechanical properties of the materials like hardness, fatigue, impact, tension and torsion.

LIST OF EXPERIMENTS:

Hardness test - a)Vickers b)Brinell c) Rockwell

Tension test

Torsion test

Impact test – a) Izod b)Charpy

Double shear strength

Open coil spring

Closed coil spring

Determination of Young's modulus of a beam

Study of fracture pattern of ductile & brittle materials

Stress- strain curves for various Engg. materials

Total Hours: 45

OUTCOMES:

Student will be able to

Evaluate the mechanical properties of materials and compare it with theoretical models

understand the fracture pattern of different specimen.

AEB 2106	THERMODYNAMICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To carry out experiments to evaluate the working of different thermodynamic systems and heat transfer mechanisms.

LIST OF EXPERIMENTS:

Performance test on a 4-stroke engine

Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine

Determination of effectiveness of a parallel flow heat exchanger

Determination of effectiveness of a counter flow heat exchanger

Determination of the viscosity coefficient of a given liquid

Coefficient of Performance test on a vapour compression refrigeration test rig

Coefficient of Performance test on a vapour compression air-conditioning test rig

Study of a Gas Turbine Engine.

Determination of Conductive Heat Transfer Coefficient.

Determination of Thermal Resistance of a Composite wall.

Total Hours: 45

OUTCOMES:

Student will be able to

Understand the thermodynamic cycles involved in 2 and 4 stroke engines.

Evaluate the performance of refrigeration and air- conditioning systems.

Evaluate the conductive and convective heat transfer coefficients of simple systems.

SEMESTER IV

MAB 2283 APPLIED NUMERICAL METHODS L T P C

3 1 0 4

OBJECTIVES:

This course gives a complete procedure to solve problems in engineering numerically, where analytical method fails to give solution.

MODULE I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 7

Linear interpolation methods (method of false position) – Newton's method – Statement of Fixed Point Theorem – Fixed point iteration: x=g(x) method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

MODULE II INTERPOLATION AND APPROXIMATION 7

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline– Newton's forward and backward difference formulas.- Relations between operators (E, ∇,μ, ,)

MODULE III NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 8

Derivatives from difference tables – Divided differences and finite differences –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson's rules.

MODULE IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical solution of first and second order ordinary differential equations by Taylor series method - Euler Method - Modified Euler's Method - Runge – Kutta Method of order four.

MODULE V NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8

Millne's Predictor and Corrector Method – Adam's Predictor-Corrector Method Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

Total Hours: 60

TEXT BOOK:

M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003.

REFERENCES:

Grewal, B.S., “Numerical methods in Engineering and Science”, 7th Edition, Khanna Publishers, 2007

C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” Pearson Education”, New Delhi 2002.

P. Dechaumphai, N. Wansophark, ”Numerical Methods in Engineering”, Narosa Publications, 2012.

OUTCOMES:

Students will be able to

solve system of equations and eigenvalue problem of a matrix numerically.

use interpolation and find intermediate values for given data.

find numerical solution of differential equations in engineering problems.

AEB 2211 HIGH SPEED AERODYNAMICS L T P C
3 1 0 4

OBJECTIVES:

To understand the effect of compressibility at high speed flows.

To understand the basics of shock and expansion waves at supersonic flows.

To introduce the compressible flow theories to assess the flow over airfoils and wings.

MODULE I ONE DIMENSIONAL COMPRESSIBLE FLOW 10

Energy, momentum, continuity and state equations, velocity of sound, adiabatic steady state flow equations, flow through converging, diverging passages, performance under various back pressures.

MODULE II NORMAL SHOCK WAVES 6

Prandtl equation and Rankine – Hugonoit relation, normal shock equations, pitot static tube, corrections for subsonic and supersonic flows

MODULE III OBLIQUE SHOCKS AND EXPANSION WAVES 10

Oblique shocks and corresponding equations, hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, Rayleigh and Fanno Flow. Flow past convex corners, expansion hodograph, reflection and interaction of shocks and expansion, waves, families of shocks, methods of characteristics, two dimensional supersonic nozzle contours.

MODULE IV DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS 13

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

MODULE V AIRFOIL IN HIGH SPEED FLOWS 9

Lower and upper critical Mach numbers, lift and drag divergence, shock induced separation, characteristics of swept wings, effects of thickness, camber and aspect ratio of wings, transonic area rule, tip effects.

MODULE VI HIGH SPEED WIND TUNNELS **12**

Blow down, in draft and induction tunnel layouts and their design features, transonic, supersonic and hypersonic tunnels and their peculiarities, helium and gun tunnels, shock tubes, optical methods of flow visualization.

Total Hours: 60

TEXT BOOKS:

John D. Anderson, Jr.,"Fundamentals of Aerodynamics", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007.

Liepmann, H. W and Roshko, A., "Elements of Gas dynamics", Dover Publication, 2002.

Pope, A. and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985

REFERENCES:

McCormick. B. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley & Sons, Inc., UK, 1995.

Anderson Jr., D., "Modern compressible flow", McGraw-Hill Book Co., New York 2003

OUTCOMES:

Students will be able to

- Perform one-dimensional isentropic flow calculations.
- Apply Normal shock/Oblique shock relations for calculation of flow field properties.
- Use Prandtl-Meyer expansion and Method of Characteristics to obtain 2D supersonic nozzle contour.
- Apply airfoil theory for the prediction of airfoil characteristics at high speeds.
- Estimate the performance of swept wings at high speed flight.
- Acquire knowledge on the working principles of high speed wind tunnels and optical flow visualization techniques

AEB 2212 AIRCRAFT STRUCTURAL MECHANICS L T P C
3 0 0 3

OBJECTIVES:

To study different types of structural members of aircraft subjected to various types of loading and support conditions.

MODULE I LOADS AND STRUCTURAL COMPONENTS OF AIRCRAFT **5**

V-n Diagram, Different structural members of aircraft, loads taken by the components general definitions.

MODULE II STATICALLY DETERMINATE STRUCTURES **6**

Plane truss analysis, method of joints, method of sections, 3D trusses.

MODULE III STATICALLY IN DETERMINATE STRUCTURES **8**

Propped Cantilever beams, Fixed-Fixed beams, Clapeyron's 3 moment theorem, moment distribution method, Maxwell's reciprocal theorem.

MODULE IV COLUMNS **6**

Inelastic buckling, Effect of initial curvature, Eccentric loading on columns, South well plot, Use of energy methods in column, Beam-columns

MODULE V ENERGY METHODS **10**

Castigliano's theorems, Unit load and Dummy load methods, application of energy methods to frames, beams, trusses and rings.

MODULE VI BIAXIAL STRESSES **10**

Stresses in thin walled and thick walled pressure vessels, combined bending torsion and axial loading of circular shafts, Mohr's circle construction.

Total Hours: 45

TEXT BOOKS:

James M Gere & Barry J. Goodno, "Mechanics of Materials, Cenage Learning", 7th Edition, 2009.

THG Megson, "Aircraft Structures for Engineering Students", Elsevier (BH), 2007.

REFERENCES:

C.T. Sun, “Mechanics of Aircraft Structures”, 2nd Edition, John Wiley & Sons. 2006.

R.C. Hibbeler, “Structural Analysis”, 5th Edition, Prentice-Hall, 2002.

B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, “Mechanics of Materials”, Firewall media, 2002.

Craig, R.R., “Mechanics of Materials”, John Wiley & Sons, New York, 1996.

R.S.Khurmi, “Strength of Materials”, 23rd Edition, S.Chand Limited, 2007

R.K.Rajput, “ Strength of Materials:Mechanics of Solid”, 4th Edition, S.Chand Limited, 2007

OUTCOMES:

Students will be able to

- Identify and relate different kinds of loads experienced in aircraft.
- Estimate the load bearing capability of different structural members used in the construction of aircraft.
- Extend the concepts of solid mechanics to in-determinate structural problems.
- Obtain theoretical predictions of structural behavior using energy methods.
- Predict the load bearing capacity of pressure vessels.
- Predict the response of the structural elements subjected to combined loading using the theoretical and the graphical method.

AEB 2213 **PROPULSION I** **L T P C**
3 0 0 3

OBJECTIVES:

To introduce the fundamentals of aircraft propulsion and the working principles of gas turbine engine components.

MODULE I FUNDAMENTALS OF AERO ENGINES **10**

Gas turbine Engine development for Aircraft propulsion , Illustration of working of Gas turbine engines - the thrust equation and other performance parameters– Factors affecting thrust, Effect of pressure, velocity and temperature changes of air entering compressor, Variants of Aircraft jet engines: Turboprop, Turbofan, Turbojet and Turboshaft – Performance characteristics and analysis, Ideal and Real Brayton cycles - Jet engine cycles for aircraft propulsion, Cycle components and efficiency, Real cycle analysis, Methods of thrust Augmentation.

MODULE II PROPELLER THEORY **5**

IC engines for aircraft application, performance parameters of IC engines, Supercharging of aircraft IC engines, Propeller fundamentals, propeller aerodynamic theories

MODULE III SUBSONIC INTAKES FOR JET ENGINES **6**

Inlets for transport Aircrafts and Military Aircrafts, Internal flow and Stall in subsonic intakes – Boundary layer separation – Major features of external flow near a subsonic intake -Relation between minimum area ratio and external deceleration ratio – Performance of subsonic intake and diffuser.

MODULE IV COMBUSTION SYSTEMS **6**

Classification of combustion chamber, combustion mechanism, Combustion parameters: Aerodynamic pressure losses – Combustion Efficiency and performance – Combustion Intensity, Factors affecting combustion chamber performance and design, Fuel Injectors, Flame tube cooling, Flame stabilization, Flame holders, Combustion instability. Numerical Problems

MODULE V NOZZLES **6**

Theory of flow in isentropic nozzles - Nozzles and choking – Nozzle throat conditions, Area-velocity relation, Isentropic flow through converging-diverging

nozzles –- over-expanded and under-expanded nozzle exit flows, Nozzle efficiency – Losses in nozzles - Interaction of jet flow with adjacent surfaces, Fixed and variable geometry nozzles – Ejector and Variable area nozzles, Thrust vector control, Thrust reversal.

MODULE VI COMPRESSORS **12**

Centrifugal Compressors - Principle of operation – work done and pressure rise - slip factor, velocity diagrams, diffuser vane design considerations, Concept of Surging, choking, prewhirl, rotating stall, Performance characteristics.

Axial Compressors - Basic operation - Elementary theory – Velocity triangles – Work and compression, Design parameters - Flow coefficient - loading coefficient - Degree of reaction - diffusion factor, Cascade Analysis - nomenclature - Loss and Blade performance estimation, Free vortex theory, Compressor blade design, Single and multi-stage axial compressor characteristics – Performance characteristics.

Total Hours: 45

TEXT BOOKS:

Saravanamuttoo, H.I.H., Rogers, G.F.C., Cohen H., Paul Straznicky, “Gas Turbine Theory”, 6th Edition, Pearson Education Canada, 2008.

Hill Philip, Peterson Carl, “Mechanics and Thermodynamics of Propulsion”, Addison Wesly, 1992.

REFERENCES:

Kroes Michael J, Wild Thomas W, “Aircraft Powerplants”, 7th Edition, Tata McGraw Hill, 2010.

Mattingly J. D., “Elements of Gas Turbine Propulsion”, Tata McGraw Hill, 2005.

El-Sayed Ahmed, “Aircraft Propulsion and gas turbine engines”, Taylor and Francis (CRC press), 2008.

“Rolls Royce Jet Engine”, 3rd Edition, 1983.

Roy Bhaskar, “Aircraft Propulsion”, Elsevier (India), 2008.

OUTCOMES:

Students will be able to

- Get proper perspective of different types of jet engines used in aircraft.
- Gain knowledge of the importance of piston engines and realize the necessity of propeller fundamentals.
- Learn major engineering features of jet engine intake.
- Acquire basic knowledge on combustion systems.
- Apply the basic design features of nozzles and visualize the effect of jet interaction.
- Be conversant with compressor performance characteristics and solve basic design problems.

AEB 2214 AIRCRAFT SYSTEMS AND INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES:

To introduce the principle and working of various aircraft systems and instruments.

MODULE I AIRPLANE CONTROL SYSTEMS 6

Conventional Systems, layouts of flying controls, Differential Aileron, Components, Push pull rods, Bell crank fully powered flight controls, Power actuated systems, Modern control systems, Digital fly by wire systems, Auto pilot system active control Technology.

MODULE II HYDRAULICS AND PNEUMATICS 10

Hydraulic systems, Study of typical workable system, components Typical airline system, Pneumatic systems Advantages, Working principles, Typical Air pressure system, Brake system, Typical Pneumatic power system, Components, Landing Gear, systems, Classification.

MODULE III ENGINE SYSTEMS 8

Fuel systems for Piston and jet engines,Components of multi engines. Lubricating systems for piston and jet engines, Starting and Ignition systems, typical examples for piston and jet engines.

MODULE IV AUXILIARY SYSTEM 8

Cabin heating, Pressurization Basic Air cycle systems, Vapor Cycle systems, Evaporative vapor cycle systems Evaporative air cycle systems, Fire protection systems, Deicing and anti icing systems.

MODULE V AIRCRAFT INSTRUMENTS 7

Flight Instruments and Navigation Instruments, Gyroscope, Accelerometers, Air speed Indicators, TAS, EAS, Mach Meters, Altimeters, Principles and operation, Study of Various types of engine instruments, Tachometer ,T emperature and pressure gauges

MODULE VI NEW DEVELOPMENTS 6

Auto pilot system, Digital fly by wire systems , Side stick Intelligent flight control system active control Technology, Electronic instrument display, EADI, EHSI , communication and Instrument landing system.

Total Hours: 45

TEXT BOOKS:

McKinley, J.L., and Bent, R.D., “Aircraft Maintenance & Repair”, McGraw-Hill, 1993.

Federal Aviation Administration, “General Hand Books of Airframe and Powerplant Mechanics”, U.S. Dept. of Transportation, , the English Book Store, New Delhi1995.

REFERENCES:

Mekinley, J.L. and Bent, R.D., “Aircraft Power Plants”, McGraw-Hill, 1993.

Pallet, E.H.J., “Aircraft Instruments & Principles”, Pitman & Co., 1993.

Treager, S., “Gas Turbine Technology”, McGraw-Hill, 1997.

OUTCOMES:

Students will be able to

- Identify the basic aircraft control surfaces and relate them with the development of various control systems.
- Acquire knowledge on the working of hydraulic, pneumatic and braking systems of aircraft.
- Identify the functions and safe operation of various engine and auxiliary systems of aircraft.
- Interpret data from various flight and navigation instruments.
- Acquire knowledge on modern aircraft control systems like fly by wire and its advantages over conventional flying controls.

SSB2181	LAW FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To familiarize with Indian Constitution and Governance of our country.

To apprise on human rights, local and International and redressal mechanism.

To provide important aspect of corporate laws

To give an introduction of important industrial and labour laws of our country.

To provide an exposure on laws on contracting and arbitration.

To give an overview on intellectual property related laws.

MODULE I INDIAN CONSTITUTION 7

Constitution – meaning and history – making of constitution – salient features, preamble, Citizenship, Fundamental rights, Fundamental duties, Equality and social justice, Directive principles, Constitutional amendments.

MODULE II GOVERNANCE AND POWERS VESTED 7

Union executive, Legislature – Union – State and union territories, Union and state relations, powers vested with parliament and state legislature, emergency provisions - People's Representations Act – Election Commission – Election for parliament and state legislature, Judiciary.

MODULE III HUMAN RIGHTS 7

Human rights – meaning and significance, International law on human rights, Covenant on civil and political rights; Covenant on Economic, social and cultural rights – protocol, UN mechanism and agencies, watch on human rights and enforcement – role of judiciary and commission, Right to information Act 2005 – evolution – concept – practice.

MODULE IV CORPORATE AND LABOUR LAWS 7

Corporate laws – meaning and scope – laws relating to companies, Companies Act 1956 – collaboration agreement for Technology transfer, Corporate liability – Civil and criminal – Industrial employment (standing orders) Act 1946, Industrial Disputes Act, 1947, Workmen's Compensation Act 1923, The Factories Act, 1948 – Industry related other specific laws.

MODULE V CONTRACTS AND ARBITRATION 9

Types of contract – standard form of contracts - General principles under Indian Contract Act, 1872 – protection against exploitation – judicial approach to contracts, Arbitration and conciliation – meaning, scope and types, model law, judicial intervention, international commercial arbitration – arbitration agreement, arbitration tribunal – powers and jurisdiction, enforcement and revision, Geneva Convention, Awards, Confidentiality.

MODULE VI LAWS RELATED TO IPR 8

IPR – Meaning and scope, International Convention – Berne and Parrys Conventions, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator, Securing of International patents.

Total Hours: 45

REFERENCES:

Jain M.P, “Indian Constitutional Law”, Wadhwa & Co., (2005)

Subhash G. & Kashyap, “Our Constitution : An introduction to India’s Constitution and Constitutional Law”, 3rd Edition, National Book Trust, India (2001)

Agarwal H.D., “International Law and Human Rights”, Central Law Publications, (2008).

Meena Rao, “Fundamental Concepts in Law of Contract”, 3rd Edition, Professional offset, (2006).

Ramappa, “Intellectual Property Rights Law in India”, Asia Law House (2010)

Avtar Singh, “Company Law”, Eastern Book Co., (2007).

Rustamji R.F., “Introduction to the Law of Industrial Disputes”, Asia Publishing House.

Acts : Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

Students will be

Familiar with Indian Constitution and Governance of our country, local and International redressal mechanism.

Familiar with intellectual property related laws.

Able to apply corporate laws, important industrial and labour laws of our country.

Able to take up managerial, professional, ethical, social and economic responsibilities.

ENB2282 CONFIDENCE BUILDING AND BEHAVIORAL SKILLS L T P C
(Common to all Branches) 0 0 2 1

OBJECTIVES:

To enable the students to develop communication skills for verbal communication in the work place.

TOPICS OUTLINE:

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES:

Introduction: Soft skills definition, examples

Verbal communication: Case study, communication and discussion

Prepared speech

Impromptu speech

Debate: Case studies - Attitude and Behavior: role play and exploration

Ability to ask for help – communication and team work

Manners and etiquette

Organization and Planning

Time keeping

Conduct in workplace

Conscientiousness

Work output

Professionalism

Motivation

Ownership of tasks

Adaptability/flexibility

ASSESSMENT:

The assessment will be continuous and portfolio based. The students must produce the record of the work done through the course of the semester in the individual classes. T he portfolio may consist of a) the individual task outline and activities, b) worked out activities c) Pre-designed sheets which may be provided by the Faculty member. The portfolio will be used by the Faculty member for assessment. The course coordinator in consultation with the course committee shall decide at the beginning of the semester, the number of exercises, method of assessment of each and the weightage for the end semester assessment.

Total Hours: 30

OUTCOMES:

Students should be able to:

Develop verbal communication skills

Debate with other students confidently

Communicate effectively their ideas

AEB 2215	AIRCRAFT COMPONENT DRAWING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To train the students to draft basic aircraft components manually and using modeling packages.

LIST OF EXPERIMENTS:

Design of riveted joints (Lap joint).

Design of riveted joints (Butt joint with single and double straps).

Design of welded joints.

Layout of typical wing structure.

Layout of typical fuselage structure.

Computer aided modeling of typical aircraft wing.

Computer aided modeling of typical fuselage structure.

Computer aided modeling of landing gear

Three view diagram of a typical aircraft

Layout of control systems

Total Hours: 45

OUTCOMES:

Students will be able to,

Gain hands-on experience in drafting aircraft components and structures using computer-aided modeling.

Gain knowledge and experience in drawing the layout of aircraft & control systems using computer-aided modeling.

AEB 2216	AERODYNAMICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To introduce the basics of Wind Tunnels and their Applications for the study of flow around different configurations and evaluation of aerodynamic forces and moments.

LIST OF EXPERIMENTS:

Calibration of subsonic wind tunnel.

Pressure distribution over smooth and rough cylinder.

Pressure distribution over symmetric airfoils.

Pressure distribution over cambered airfoils & thin airfoils

Force measurement using wind tunnel balance.

Flow over a flat plate at different angles of incidence

Flow visualization studies in low speed flows over cylinders

Flow visualization studies in low speed flows over airfoil with different angle of incidence

Calibration of supersonic wind tunnel.

Supersonic flow visualization with Schlieren system.

Total Hours: 45

OUTCOMES:

Students will be able to

Measure flow velocity, lift and drag coefficients using wind tunnels.

Understand the dependence of airfoil pressure distribution on the lift coefficient.

Use the flow visualization techniques to visualize compressible and incompressible flows.

AEB 2217	AIRCRAFT SYSTEMS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To train the students to assess the Aircraft Systems and carryout maintenance practices.

LIST OF EXPERIMENTS:

Aircraft “Jacking Up” procedure.

Aircraft “Leveling” procedure.

Control system “Rigging check” procedure.

Aircraft “Symmetry Check” procedure.

“Flow test” to assess of filter element clogging.

“Pressure test” to assess hydraulic External/ Internal Leakage.

“Test of Brake System” and “Bleeding of Brake System”.

“Pressure test” procedure on fuel system component.

“Break Torque Load Test” on wheel brake units.

Maintenance and rectification of snags in hydraulic and fuel systems.

Total Hours: 45

OUTCOMES:

Students will able to

Understand the working of various aircraft systems.

Identify the snags in aircraft hydraulic and fuel systems and their rectifications.

SEMESTER V

AEB 3101	**PROPULSION II**	**L T P C** **3 1 0 4**

OBJECTIVES:

To introduce the working of aircraft engine components, their matching and the concepts of rocket & advanced propulsion.

MODULE I AIRCRAFT ENGINE TURBINES 14

Axial Turbines - Elementary theory – vortex theory – choice of blade profile, pitch and chord, Turbine stage - Turbine blade 2D (cascade analysis), Work done - degree of reaction - stage design, Losses, efficiency and performance, Rotor blade and disc stresses, Multi-staging of turbine, Turbine cooling technology, Overall turbine performance. Radial flow turbines: Radial turbine Aerodynamics and thermodynamics, Losses in radial turbine and efficiency

MODULE II SUPERSONIC INTAKES 6

Supersonic inlet flows - Starting problems in supersonic inlets — Shock swallowing by area variation - External deceleration - Modes of inlet operation – Supersonic inlet performance

MODULE III AIRCRAFT ENGINE INSTALLED PERFORMANCE, SIZING & MATCHING 8

Introduction to engine component sizing, Installed performance of Engine – Dimensional analysis for component matching, Engine Design Point operations, Engine Off Design operations - Single shaft engine – Two shaft: Turbojet & Turbo-prop, Turboshaft engines. The Engine operating lines – Operational details of multiple shaft engines, Aircraft Engine Component matching: Intake-Compressor Matching, Turbine Nozzle matching, Compressor – Turbine matching: Single and multi-spool. Free turbine and unducted Fan/Propeller Matching.

MODULE IV RAMJET PROPULSION 10

Operating principle – sub critical, critical and supercritical operation – combustion in ramjet engine – ramjet performance – sample ramjet design calculations – introduction to scramjet – preliminary concepts in supersonic combustion – integral ram- rocket- numerical problems.

MODULE V FUNDAMENTALS OF ROCKET PROPULSION 14

Operating principle – specific impulse of a rocket – internal ballistics- rocket nozzle classification – rocket performance considerations solid propellant rockets – selection criteria of solid propellants – important hardware components of solid rockets – propellant grain design considerations – liquid propellant rockets – selection of liquid propellants – thrust control in liquid rockets – cooling in liquid rockets – limitations of hybrid rockets – relative advantages of liquid rockets over solid rockets- numerical problems.

MODULE VI ADVANCED PROPULSION 8

Electric rocket propulsion – ion propulsion techniques – nuclear rocket – types – solar sail- preliminary concepts in nozzleless propulsion.

Total Hours: 60

TEXT BOOKS:

Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., "Gas Turbine Theory", Pearson Education Ltd., 2009.

Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion", Pearson Education Inc., 2010.

Sutton, G.P., Oscar biblarz, "Rocket Propulsion Elements", 8th Edition, John Wiley & Sons Inc., New York, 2010.

REFERENCES:

Mattingly J. D., "Elements of Gas Turbine Propulsion", Tata McGraw Hill, 2005

Kroes Michael J, Wild Thomas W, "Aircraft Powerplants", 7th Edition, Tata McGraw Hill, 2010.

El-Sayed Ahmed, "Aircraft Propulsion and gas turbine engines, Taylor and Francis (CRC press), 2008.

"Rolls Royce Jet Engine", Third Edition, 1983.

Roy Bhaskar, "Aircraft Propulsion", Elsevier (India), 2008.

Gordon, C.O., "Aerothermodynamics of Gas Turbine and Rocket Propulsion", 3rd Edition, AIAA Education Series, New York, 1998.

Seddon, J., Goldsmith, E.L. "Intake Aerodynamics", 2nd Edition., AIAA Education series, 1999.

OUTCOMES:

Students will be able to

- Perform basic design calculations of gas turbines.
- Evaluate the performance of supersonic inlet.
- Solve simple problems related to performance and matching of aircraft engine components.
- Apply the concept of ramjet propulsion for simple ramjet design calculations.
- Apply the fundamentals of solid and liquid rocket propulsion to solve basic problems.
- Acquire knowledge of advanced propulsion techniques.

AEB 3102 EXPERIMENTAL AERODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

To introduce various types of wind tunnels and measurement techniques.

MODULE I WIND TUNNEL TESTING 5

Introduction - Need of experiments - Wind tunnel - Classification of wind tunnels Applications of wind tunnels - Model making, non-dimensional simulation parameters

MODULE II LOW SPEED WIND TUNNELS 8

Irregularities of flow in low speed tunnels, Reduction of turbulence - Effect of screens on turbulence - Honeycombs - Wind tunnel contractions -The diffuser, Losses in wind tunnel circuit, Power requirements – Power economy by pressurization - Power economy by choice of working fluid - Power economy by reduction in stagnation temperature.

MODULE III HIGH SPEED WIND TUNNELS 10

Types of high speed tunnels , Supersonic wind tunnels - Test section flow parameters - Dynamic pressure - Mass flow rate - Test section velocity - Maximum velocity - Free stream Reynold's number, Components of supersonic wind tunnels - Air storage tanks - Settling chamber /wide angle diffusers - Convergent-divergent (C-D) nozzle – Diffuser, Power required for the operation of supersonic wind tunnels, Closed circuit supersonic wind tunnel, Actual flow in the supersonic wind tunnel - Starting the wind tunnel with the model in the test section, Sizing of the wind tunnel model, Problems in the operation of the supersonic wind tunnel - Condensation and Liquefaction, Shock tubes – operation and equations.

MODULE IV MEASUREMENT TECHNIQUES 8

Steady and unsteady pressure, velocity and temperature measurements – Force and moment measurements – three component and six component balances – internal balances – Principles of Hotwire anemometer, PIV, LDV.

MODULE V FLOW VISUALISATION 6

Smoke and tuft grid techniques – dye injection special techniques – optical methods of flow visualization.

MODULE VI SPECIAL PROBLEMS **8**

Pitot-static tube correction for subsonic and supersonic Mach numbers-boundary layer velocity profile on the tunnel test sections by Momentum-Integral method - Calculation of CD from wall shear stress – Hypersonic facilities and Heating requirements for the simulation of re-entry bodies.

Total Hours: 45

TEXT BOOKS:

Barlow J. B., Rae W.H. and Pope A., "Low speed wind tunnel testing" , 3rd Edition, Wiley-Interscience, 1999.

Pope. A and Goin K.L., "High speed wind tunnel testing", John Wiley, 1985

REFERENCES:

Anderson, J.D., "Fundamentals of Aerodynamics", McGraw Hill Book Co., 1999

Anderson, J.D., "Introduction to Flight", 5th Edition (Special Indian Edition), 2009

Bendat J. S., and Peirsol A. G., "Random Data Analysis and Measurement Procedures", 4th Edition, Wiley, 2010.

Rathakrishnan. E "Instrumentation, Measurement and Experiments in Fluids", CRC Press, London, 2007

Goldstein R. J. (Ed.), Francis T., "Fluid Mechanics Measurements", Taylor Francis, Washington 1996.

W-J Yang, "Handbook of Flow Visualization", 2nd Edition, Taylor and Francis, 2001.

Tropea C., Yarin A., Foss F. J. (Eds.), "Handbook of Experimental Fluid Mechanics", Springer, 2007

OUTCOMES:

Students will be able to

- Identify and relate the need for Wind Tunnel Testing.
- Acquire knowledge of the design and operation features of low speed wind tunnels.
- Gain knowledge on the design and operation features of high speed wind tunnels.
- Identify and use various flow measuring devices and techniques for the measurement of flow properties, forces and moments.
- Identify and use the flow visualization techniques in compressible and incompressible flows.
- Acquire knowledge of the hypersonic reentry body simulation and measurements.

AEB 3103 AIRCRAFT STRUCTURAL ANALYSIS L T P C
3 1 0 4

OBJECTIVES:

To introduce the analysis of various structural components under different loading conditions and the fundamentals of elasticity.

MODULE I UNSYMMETRICAL BENDING OF BEAMS (CROSS SECTIONS) 8

Bending Stresses in beams of unsymmetrical sections, bending of sections with skew loads, Structural Idealization, bending stress in the wing box.

MODULE II SHEAR FLOW IN OPEN SECTIONS 10

Thin walled beams, concept of shear flow, shear centre, elastic axis,With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

MODULE III SHEAR FLOW IN CLOSED SECTIONS 10

Bredt – Batho formula, single and multi – cell structures. Shear flow in single multicell structures under torsion, Shear flow in single and multicell under bending with walls effective and ineffective.

MODULE IV BUCKLING OF PLATES 12

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

MODULE V STRESS ANALYSIS IN WING AND FUSELAGE 10

Procedure – Shear and bending moment distribution of wings and fuselage, thin webbed beam. Shear resistant web beams, Tension field web beams (Wagner's).

MODULE VI BASICS OF ELASTICITY 10

Definitions, equations of equilibrium, strain displacement relationships, Stress – Strain relationship, Compatibility equations.

Total Hours: 60

TEXT BOOKS:

THG Megson, “Aircraft Structures for Engineering Students”, 4th Edition, Elsevier (BH) 2007.

Elmer Franklin Bruhn, “Analysis and Design of Flight Vehicle Structures”, S.R. Jacobs, 1973.

REFERENCES:

David J Peery, Jamal J Azar, “Aircraft Structures”, 2nd Edition, McGraw Hill,1982.

R.M Rivello, “Theory and Analysis of Flight Structures”, Illustrated Edition, McGraw Hill, 1969.

B. Donaldson, “Analysis of Aircraft Structures: An Introduction”, Cambridge University Press.

OUTCOMES:

Students will be able to

- Analyze the bending stresses of the structural members of aircraft.
- Analyze the shear flow of the open walled thin sections of the aircraft.
- Calculate the shear flow of the closed walled thin sections of the aircraft.
- Obtain analytical solutions for the buckling of finite plates.
- Carry out stress analysis on wing and fuselage.
- Differentiate between theory of elasticity and solid mechanics approaches in solving aircraft structural problems.

AEB 3104	AIRCRAFT MATERIALS	L T P C 3 0 0 3

OBJECTIVES:

To introduce types of materials used in aircraft, their characteristics and applications.

MODULE I INTRODUCTION TO AIRCRAFT MATERIALS 7

General properties of materials, definition of terms, requirements of aircraft materials, testing of aircraft materials, inspection methods, application and trends in usage in aircraft structures and engines, introduction to smart materials and nanomaterials; selection of materials for use in aircraft.

MODULE II AIRCRAFT METAL ALLOYS 6

Aluminum alloys, magnesium alloys, titanium alloys, plain carbon and low carbon steels, corrosion and heat resistant steels, maraging steels, copper alloys,Producibility and surface treatments aspects for each of the above.

MODULE III AIRCRAFT SUPERALLOYS AND CORROSION 7

General introduction to superalloys, nickel based superalloys, cobalt based superalloys,and iron based superalloys, manufacturing processes associated with superalloys, heat treatment and surface treatment of superalloys. Knowledge of the various methods used for removal of corrosion from common aircraft metals and methods employed to prevent corrosion.

MODULE IV COMPOSITE MATERIALS 8

Definition and comparison of composites with conventional monolithic materials, reinforcing fibers and matrix materials, carbon-carbon composites production, , inter metallic matrix composites, ablative composites based on polymers, ceramic matrix, metal matrix composites based on aluminum, magnesium, titanium and nickel based composites for engines.

MODULE V POLYMERIC MATERIALS, CERAMICS&GLASS 9

Knowledge and identification of physical characteristics of commonly used polymeric material: plastics and its categories, properties and applications; commonly used ceramic, glass and transparent plastics, properties and applications, adhesives and sealants and their applications in aircraft.

MODULE VI AIRCRAFT WOOD, RUBBER, FABRICS & DOPE AND PAINT **8**

Classification and properties of wood, seasoning of wood, aircraft woods, their properties and applications, joining processes for wood, plywood; characteristics and definition of terminologies pertaining to aircraft fabrics and their applications, purpose of doping and commonly used dopes; purpose of painting, types of aircraft paints, aircraft painting process.

Total Hours: 45

TEXT BOOK:

Kenneth. G.Budinski& Michael .K. Budinski, “Engineering material properties and selection”, Prentice Hall publications, 2010.

REFERENCE:

F.C Campbell,” Manufacturing technology for aerospace structural materials”, Elsevier publication.

OUTCOMES:

Students will be able to

- Identify & select suitable materials for different parts of aircraft based on their characteristics and properties.
- Visualize the need for different alloying materials and their production processes.
- Gain knowledge of the necessity and engineering advantages of super alloys in aircraft industry and the methods for removal of corrosion.
- Acquire knowledge on the basics of different composite materials.
- Gain knowledge on polymeric materials, ceramics, glass, adhesives, sealants and their fittingness in aircraft.
- Select suitable surface treatment (painting) and doping process pertaining to aircraft fabrics.

MSB3181 MANAGEMENT OF BUSINESS ORGANISATION **L T P C**
3 0 0 3

OBJECTIVES:

To give an exposure to principles of management and organizational structures
To introduce concepts of operation and material management
To provide an understanding of management of human resources.
To impart some basic knowledge on marketing, pricing and selling.
To give an overview of accounting and management of finance.

MODULE I PRINCIPLES OF MANAGEMENT **7**

Functions of management – planning – organizing – staffing – direction – motivation – communication – coordination – control, organizational structures – line – line and staff – matrix type, functional relationships – span of control, Management by Objectives (MBO) – Forms of Industrial ownership

MODULE II OPERATIONS MANAGEMENT **8**

Introduction to operations management – functions of production/operations management – types of production, Overview of facility location – lay out planning, introduction to production planning and control, work study, quality assurance, lean manufacturing and six sigma, plant maintenance and management.

MODULE III MATERIALS MANAGEMENT **8**

Materials Planning - types of inventory, Purchasing function – source selection– negotiation – ordering, Stores management – functions - types of stores – overview of inventory control, Introduction to newer concepts: MRP-I – MRP-II– ERP – JIT.

MODULE IV HUMAN RESOURCE MANAGEMENT **7**

Human Resource Management – objectives – role of Human Resource Manager –manpower planning – selection and placement – training – motivation– performance assessment - Introduction to grievances handling and labour welfare.

MODULE V MARKETING MANAGEMENT **7**

Marketing – concept and definition – Elements of marketing mix – PLC - Steps

in new product development – Pricing objectives and methods – Advertising types/media – Steps in personal selling – Sales promotion methods - Distribution channels: functions, types

MODULE VI FINANCIAL MANAGEMENT 8

Financial management functions – introduction to financial accounts, financial performance – profit and loss account statement – balance sheet, budgetary control – meaning – uses – limitations – types of costs – basics of depreciation methods – break-even analysis – meaning – assumption – uses and limitations, working capital – meaning and relevance – Use of operating ratios

Total Hours: 45

REFERENCES:

Bhushan Y.K., “Fundamentals of Business Organisation and Management”, Sultan Chand & Co., 2003.

Banga & Sharma “Industrial Engineering & Management”, 11th Edition, Khanna Publications, 2007.

Khanna, O.P., “Industrial Engineering & Management”, Dhanpat Rai Publications, 2004.

S.N.Maheswari, “Principles of Management Accounting”, 16th edition, S.Chand & Company Ltd., 2007.

OUTCOMES:

After doing the course

The students would have gained basic knowledge of the concepts of management and the functions of management

The students would have learnt fundamentals of the functional areas of management viz., operations management, materials management, marketing management, human resources management and financial management

ENB3181	CAREER BUILDING & PEOPLE SKILL (Common to all branches)	L T P C 0 0 2 1

OBJECTIVES:

To prepare the students for building their competencies and career building skill.

COURSE OUTLINE:

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES:

Preparation for the placement

Group discussions: Do's and Don'ts – handling of Group discussions – What evaluators look for.

Interview – awareness of facing questions – Do's and Don'ts of personal interview.

Selection of appropriate field vis-à-vis personality / interest.

Preparation of Resume–Objectives, profiles vis-à-vis companies requirement.

Enabling students to prepare for different procedures / levels to enter into any company – books / websites to help for further preparation.

Technical interview – how to prepare and face it.

Workplace skills

Presentation skills

Oral presentations

Technical presentations

Business presentations

Technical writing ToInterpersonal relationships – with colleagues – clients – understanding one's own behavior – perception by others.

ASSESSMENT:

As the course is practical one, it will be assessed using a portfolio based assessment. The students must in consultation with the Faculty member, plan a portfolio of evidence for the above mentioned activities. The students must develop a résumé or résumés that promote own ability to meet specific job requirements and plan their portfolio in a format appropriate to industry they wish to target. The case studies will contain direct observation of the candidate developing career plans, résumés and skills portfolio, reflect written or oral questioning to assess knowledge and problem-solving activities to assess ability to align career aspirations with realistic career goals. The course coordinator in consultation with the course committee will decide the number of exercises and mark to be awarded for each beside the weightage for the end semester assessment.

Total Hours: 30

OUTCOMES:

Students will be able to

Develop team work skills

Take part effectively in various selection procedures followed by the recruiters.

AEB 3105	AIRCRAFT STRUCTURES LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To carryout experiments to study the load-deflection characteristics of beams and the response of structural members under various loading conditions.

LIST OF EXPERIMENTS:

Determination of Young's Modulus for the given material (statically determinate beam) and verify Maxwell's reciprocal theorem for the same using extensometers

Determination of Young's Modulus for the given material (statically indeterminate beam) and verify Maxwell's reciprocal theorem for the same using extensometers.

Southwell – plot.

Unsymmetrical bending of beams

Determination of Shear center for Closed and Open Section.

Constant Strength Beam

Beam with combined loading.

Calibration of photo-elastic material and determination of Stresses in circular discs and beams.

Vibrations of beams

Wagner's beam.

Total Hours : 45

OUTCOMES:

Students will be able to

Evaluate the material properties of aircraft structural members.

Obtain experimental results of static and dynamic structural responses and compare with that of theoretical values.

Determine the stress pattern for different cross sections using photo-elastic apparatus.

AEB 3106	PROPULSION LAB	L T P C
		0 0 3 1

OBJECTIVES:

To carryout experiments to study the functions of aircraft engine components, basics of heat transfer, combustion and engine exhaust characteristics.

LIST OF EXPERIMENTS:

Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)

Study of an aircraft jet engine (Includes study of assembly of sub systems, various components, their functions and operating principles)

Study of forced convective heat transfer over a flat plate.

Study of free convective heat transfer over a flat plate.

Study of flow through axial compressor blade row.

Study of performance of a propeller.

Determination of heat of combustion of aviation fuel.

Study of free jet

Study of wall jet

Measurement of nozzle flow.

Total Hours: 45

OUTCOMES:

Students will able to

Understand the principles of heat transfer.

Analyze the flow through an axial compressor and nozzle.

Evaluate the performance of a typical propeller.

Evaluate the heat of combustion of typical aviation fuels.

AEB 3107	CAD / CAM LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

To introduce the fundamentals of computer aided design and manufacturing of simple structural elements.

A. COMPUTER AIDED DESIGN **24**

Analysis of simple structures like axially loaded members, trusses and beams

Analysis of plates loaded axially and laterally

Stress analysis of circular shafts subjected to torsion

Stress analysis of brackets and housings

Structural analysis of a Aircraft component

Post processing of analysis results

B. COMPUTER AIDED MANUFACTURING **21**

Manual Part Programming and machining in CNC Turning Center

Manual Part Programming and machining in a CNC Milling Center

Generating CNC codes for turning and milling parts using a CAM software

Integration of CAM software and CNC machines

Total Hours: 45

OUTCOMES:

Students will be able to,

Gain knowledge on the process of designing and analyzing various structural members using commercially available analysis software packages.

Understand the integration of CAM software and CNC machines; generate CNC codes for machining the parts using CAM software.

SEMESTER VI

AEB 3211	**FLIGHT DYNAMICS**	**L T P C** **3 0 0 3**

OBJECTIVES:

To introduce the study of performance and stability characteristics of aircraft under various operating conditions and atmospheric disturbances.

MODULE I DRAG ON THE AIRPLANE 7

Forces and moments acting on a flight vehicle , equation of motion of a rigid flight vehicle , different types of drag , drag polar of vehicles from low speed to high speeds , variation of thrust, power and SFC with velocity and altitudes for air breathing engines and rockets , power available and power required curves.

MODULE II AIRCRAFT PERFORMANCE 8

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

MODULE III STATIC LONGITUDINAL STABILITYAND CONTROL 8

Degree of freedom of rigid bodies in space , Static and dynamic stability– static longitudinal stability , stick fixed stability , basic equilibrium equation , stability criterion , effects of fuselage and nacelle , influence of CG location , power effects , stick fixed neutral point , stick free stability, Hinge moment coefficient , stick free neutral points, symmetric maneuvers , stick force gradients , aerodynamic balancing.

MODULE IV DIRECTIONAL STABILITY AND CONTROL 7

Static directional stability rudder fixed – directional control, Stick free directional stability adverse yaw effects –slip stream rotation –crosswind during takeoff and landing, spinning, Anti symmetric power

MODULE V LATERAL STABILITY AND CONTROL 6

Dihedral effect –estimation of airplane dihedral effect–effects of wing sweeps, flaps, power on dihedral effect, lateral control – Aileron control forces, aileron levers

MODULE VI DYNAMIC STABILITY **9**

Equation of longitudinal motion –Evaluation of stability derivatives –solution of equation of motion (stick fixed case),solution of equation of motion (stick free case) –lateral dynamics – lateral degrees of freedom, characteristics motion of the airplane with control locked., Evaluation of stability derivatives, response to aileron control , response to aileron with adverse yaw, dynamic lateral stability rudder free, aileron free.

Total Hours: 45

TEXTBOOKS:

Anderson, J.D., “Aircraft performance and design”, McGraw Hill, 1995.

Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son, Inc, New York, 2011.

REFERENCE:

Nelson, R.C. “Flight Stability and Automatic Control”, McGraw Hill Book Co., 1998.

OUTCOMES:

Students will be able to

- Calculate the performance parameters of the aircraft during steady level flight, climb, cruise, descent, take off and landing.
- Obtain drag polar of the aircraft.
- Construct the V-n diagram for aircraft.
- Calculate the basic design parameters such as range and endurance.
- Gain knowledge of static stability of the aircraft.
- Acquire knowledge of dynamic stability of the aircraft..

AEB 3212 THEORY OF ELASTICITY L T P C
3 0 0 3

OBJECTIVES:

To introduce the theoretical concepts of material behavior with elastic properties.

MODULE I ANALYSIS OF STRESS 7

Definitions, stress tensors, notations and sign conventions for stress, equations of equilibrium, principle stresses in three dimensions, Saint Venant's principle, problems.

MODULE II ANALYSIS OF STRAIN 7

Strain – displacement relations, stress – strain relations, Lame's constant – cubical dilation, compressibility of material, bulk modulus, shear modulus, compatibility equations for stresses and strains, problems.

MODULE III PLANE STRESS AND PLANE STRAIN PROBLEMS 9

Airy's stress function, bi-harmonic equations, polynomial solutions, simple two-dimensional problems in cartesian coordinates like bending of cantilever and simply supported beams, etc.

MODULE IV POLAR COORDINATES 7

Equations of equilibrium, strain displacement relations, stress-strain relations, problems axi-symmetric Equilibrium and strain displacement relations

MODULE V STRESS CONCENTRATION 7

Stress due to concentrated load, stress distribution near concentrated load acting on beam, Kirsch and Boussinesque problems.

MODULE VI TORSION 8

Navier's theory, St. Venant's theory, Prandtl's theory on torsion, the semi-inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections.

Total Hours: 45

TEXT BOOK:

Timoshenko, S., and Goodie, T.N., “Theory of Elasticity”, Tata McGraw Hill, 2010.

REFERENCES:

Enrico Volterra & J.H. Caines, “Advanced Strength of Materials”, Prentice Hall, New Jersey, 1991.

Wang, C.T., ‘Applied Elasticity”, McGraw Hill Co., New York, 1993.

Atkin, R. J., & Fox, N., “An Introduction to the theory of Elasticity”, Dover publication, 2005.

Ansel C. Ugural and Fenter S. K., “Advanced strength and applied elasticity”, prentice hall, 2003.

OUTCOMES:

Students will be able to

- Determine the components of stress and strain tensors.
- Apply the conditions of compatibility and equations of equilibrium.
- Express the mechanical characteristics of materials, constitutive equations and generalized Hook law.
- Gain knowledge of Lame’s equation and Beltrami - Michell equations.
- Determine the boundary restrictions in calculations.
- Solve the basic problems of the theory of elasticity by using Airy function expressed as biharmonic function.

EIB 3281 BASIC ELECTRONICS AND CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

To acquaint the students to semiconductor devices and their applications

To introduce the basic methods of designing the digital circuits and provide the fundamental concepts used in the design of digital systems

To introduce some knowledge about the microprocessor and its programming

To introduce the basic knowledge of flight control system and flight Deck

MODULE I SEMI CONDUCTOR DEVICES 8

Intrduction to Semi conductor – PN Junction diode – Zener Diode – Tunnel Diode – Transistor – FET and MOSFET – Silicon Controlled Rectifier, Diac and Triac – Half wave and full wave Rectifier – Filter – Ripple Factor – Regulators– Principle and Types of Transistor Amplifiers.

MODULE II LINEAR AND DIGITAL ICS 8

Number representation – Binary, Octal and Hexadecimal Number Systems – Logic families and Logic Gates – Half and full Adder – Multiplexers – Demultiplexers – Decoders – Encoders – Flip-flops – Registers – Counters IC Technology – Fabrication of Linear and Digital IC's – D/A and A/D converters – Comparison between Analog and Digital systems

MODULE III 8085 MICROPROESSOR 8

Introduction to Microprocessor - Block diagram of 8085 Microprocessor – Architecture of Intel 8085 – Microprocessor

MODULE IV INSTRUCTION SET FOR 8085 7

Addressing modes of 8085 – Instruction set classification- arithmetic instruction logical instruction –data transfer instruction-branch instruction-PUSH, POP , call and jump instruction– Simple programs using 8085.

MODULE V SYSTEM AND THEIR REPRESENTATION 8

Basic elements of control system – Open and closed loop system – transfer function- transfer function – block diagram reduction - Mathematical model of Physical systems: Thermal system, Pneumatic system, Hydraulic system, Flight Control system.

MODULE VI TIME REPSONSE AND FREQUENCY RESPONSE 6

Time response-test signals –response of first and second order systems for unit step input – Time domain Specification - Frequency response:Bode plot - Specification:Gain margin and Phase margin.

Total Hours: 45

TEXT BOOKS:

V.K. Mehta, “Principles of Electronics”, 2nd Edition, S. Chand & Co., New Delhi, 2002.

Goankar R.S, “Microprocessors, Programming to Architecture 8085”, 5th Edition, Penram International publishing Pvt. Ltd., New Delhi, 2002.

Ogata, Modern Control Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.

M.M. Mano, “Digital Design”, 3rd Edition, Prentice Hall of India.

Nagrath & Gopal, “Control System Engineering”, 3rd Edition, New Age International Edition, 2002.

REFERENCES:

Douglas, Hall, “Microprocessors and Interfacing”, Revised edition, Tata McGraw Hill, 1990.

Jacob Millman & Christos C. Halkias, “Electronic Devices and Circuits” Tata McGraw Hill, 1991.

OUTCOMES:

Students will be able to

- Gain knowledge about basic avionic system using various semiconductor devices.
- Keep abreast of the latest digital technology and design of various digital logic circuits.
- Gain knowledge of the operation of the microprocessor and its interfacing devices.
- Apply the programming techniques in developing the assembly language program for microprocessor application.
- Differentiate between the open loop and closed loop of a control system.
- Analyze the stability of the control systems using time and frequency domain analysis.

GEB 3201 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
(Common for all branches) 3 0 0 3

OBJECTIVES:

To impart the basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.

Module I PHYSICAL ENVIRONMENT 8

Earth's surface - the Interior of Earth – Plate Tectonics – Composition of the Crust: Rocks – formation and types, Soils – formation and components – soil profile.

Atmosphere – structure and composition – weather and climate – tropospheric airflow - Hydrosphere – water budget – hydrological cycle – Rainwater and precipitation, River Water and solids, Lake Water and stratification, Seawater and solids, soil moisture and groundwater.

Bioelement cycling – The Oxygen cycles – the carbon cycle – the nitrogen cycle – the phosphorous cycle – the sulfur cycle sodium, potassium and magnesium cycles.

Module IIBIOLOGICAL ENVIRONMENT 7

Cellular basis of life – prokaryotes and eukaryotes – cell respiration – photosynthesis – DNA and RNA – genetically modified life - Population dynamics – population – population growth – survival and growth curves – population regulation – future of human population

Biological communities - Five major interactions: competition, predation, parasitism, mutualism and commensalism – Concepts of habitat and niche – natural selection – species richness and species diversity – ecological succession and climax.

Ecosystem and Biomes – Food Chains and food webs – biomagnifications – ecological pyramids - Trophic levels – Energy flow in ecosystem – ecosystem stability – Terrestrial and aquatic biomes.

Module III IMPACTS ON NATURAL RESOURCES AND CONSERVATION 9

Biological resources – nature and importance – direct damage – introduced species – Habitat degradation, loss and fragmentation – Values of biodiversity–

hotspots of biodiversity, threats to biodiversity- endangered and endemic species of India- conservation of biodiversity, in-situ and ex-situ conservation

Land Utilization – past patterns of land use – Urban and Industrial development– deforestation, salinisation, soil erosion, and desertification – Modern Agriculture and Impacts

Waste management – types of solid wastes: domestic, municipal, industrial and e-wastes - disposal options – reduce, recovery, reuse – waste minimization, cleaner production technology.

Module IV IMPACTS ON WATER AND AIR AND CONSERVATION 8

Water pollution – organic oxygen demanding wastes – anthropogenic phosphate and eutrophication - Ground water contamination – Usage of fertilizer and pesticides– acid rain –acid mine discharges – toxic metals – organochlorines – endocrine disrupting substances- treatment process – Rain water harvesting and watershed management- manmade radionuclide's – thermal pollution

Atmospheric pollution – primary and secondary pollutants – anthropogenic, xenobiotic, synergism, sources and sink, residence time, levels and impacts of major pollutants – processes leading to smog, acid rain, global warming, stratospheric ozone depletion - Noise pollution and abatement.

Module V IMPACTS ON ENERGY AND CONSERVATION, ENVIRONMENTAL CRISIS 8

Energy – Renewable and non renewable energy resources – thermal power plants – nuclear fuels, fossil fuels, solar energy, wind energy, wave energy, tidal energy, ocean thermal energy, hydropower, geothermal energy, biomass energy

Environment crisis – state of environment in developed and developing countries- managing environmental challenges for future – disaster management, floods, earthquake, cyclone and landslides.

Module VI ENVIRONMENTAL IMPACT ASSESSMENT AND SUSTAINABILITY 5

Environmental Impact Assessment – Impacts: magnitude and significance – steps in EIA – methods – precautionary principle and polluter pays principle –

role of NGOs and Public – value education –Environment protection act (air, water, wild life) and forest Conservation act

Concept of Sustainability – Sustainable Development – Gaia Hypothesis - Traditional Knowledge for sustainability.

Total Hours: 45

TEXT BOOKS:

Andrew R. W. Jackson and Julie M. Jackson, “Environmental Science (The Natural Environment and Human Impact)”, Pearson Education Limited, Harlow, Essex, England, 2000.

G Tyler Miller, Jr., Thomson Brooks/Cole, “Environmental Science (Working with the Earth)”, 2006.

REFERENCES:

David McGeary and Charles C Plummer, “Physical Geology, Earth Revealed”, WCB McGraw Hill, 1998.

Bryan G. Norton, “Sustainability: A Philosophy of Adaptive Ecosystem Management”, 2005.

Larry W. Canter, “Environmental Impact Assessment”, McGraw Hill, 1996.

James Lovelock, “The Revenge of Gaia: Why the Earth is Fighting Back and How We Can Still Save Humanity”, Penguin UK, 2007

OUTCOMES:

Students will be able to

Gain the basic scientific knowledge on the environment, human impacts on various elements of environment and their assessment tools.

AEB 3213	AIRCRAFT DESIGN PROJECT – I	L	T	P	C
		1	0	3	2

OBJECTIVES:

To train the students on preliminary aircraft design work using suitable procedures to evolve the basic configuration design.

Comparative configuration study of different types of airplanes

Comparative study on specification and performance details of aircraft

Preparation of comparative data sheets

Work sheet layout procedures

Comparative graphs preparation and selection of main parameters for the design

Preliminary weight estimations, selection of main parameters,

Power plant selection, Aerofoil selection, Wing tail and control surfaces

Preparation of layouts of balance diagram and three view drawings

Drag estimation

Detailed performance calculations and stability estimates

Total Hours: 45

OUTCOMES:

Students will be able to

Identify information requirements and sources for aircraft design and evaluation.

Apply the fundamental principles of Aerodynamics, Flight performance & stability and propulsion to evolve the configuration of an aircraft.

Learn to work as a team to achieve the goal.

Apply cognitive design skills to generic design problems.

AEB 3214	AIRCRAFT STRUCTURES REPAIR AND ENGINE MAINTENANCE LAB	L T P C 0 0 3 1

OBJECTIVES:

To give hands on training to the students on engine maintenance, assessment & repair of aircraft structures using various techniques.

LIST OF EXPERIMENTS:

Stripping of piston engine, visual inspection, and assembly.

Stripping of Jet engine, visual inspection, and assembly.

NDT Check of Engine components by Die penetrate method.

NDT Check of Engine components by Magnetic particle indicator.

Welded patch repair by TIG.

Welded patch repair by MIG.

Welded patch repair by plasma Arc.

Riveted patch repairs.

Fabrication of composites.

Sheet metal forming.

Total Hours: 45

OUTCOMES:

Students will be able to

Understand the functional requirements of different Aircraft structural components and the engine components.

Identify the defects and repair the damaged structural components by riveting, patchwork, welding and carpentry methods and maintain them safely.

Detect the mechanical defects of engine components using NDT methods.

EIB 3281	BASIC ELECTRONICS AND CONTROL SYSTEMS LAB	L T P C 0 0 3 1

OBJECTIVES:

To acquaint the students to semiconductor devices and their applications

To introduce the basic methods of designing the digital circuits and provide the fundamental concepts used in the design of digital systems

To introduce some knowledge about the microprocessor and its programming

To introduce the basic knowledge of flight control system and flight Deck

LIST OF EXPERIMENTS:

Static characteristics of PN junction diode

Static characteristics of zener diode

Clippers and clampers

Study of logic gates

Design of half adder and full adder.

Design of SR and JK flipflop using gates

Design of T and D flipflop using gates.

Introduction to Arithmetic and logical programs using 8085 microprocessor

Study of control system toolbox using MATLAB software.

Bode plot and determination of phase and gain margin using MATLAB software

Total Hours: 45

OUTCOMES:

Students will be able to

Demonstrate the ability to design a system using various semiconductor devices.

Keep abreast of the latest digital technology and design of various digital logic circuits.

Demonstrate the fundamental understanding of the operation of the microprocessor and its interfacing devices.

Apply the programming techniques in developing the assembly language program for microprocessor application.

Describe the response characteristics and differentiate between the open loop and closed loop of a control system.

SEMESTER VII

AEB 4101	**AVIONICS**	**L T P C** **3 0 0 3**

OBJECTIVES:

To introduce the basic concepts of avionics systems utilized in Aircraft.

MODULE I INTRODUCTION **7**

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies.

MODULE II PRINCIPLE OF DIGITAL SYSTEMS **7**

Digital computer –Digital number system- number systems and codes- fundamentals of logic and combinational logic circuits- Digital arithmetic- interfacing with analogue systems- Microprocessor basics- intel 8085,8086 microprocessor- Memories.

MODULE III DIGITAL AVIONICS ARCHITECTURE: **8**

Avionics system architecture – salient features and application of Data buses – MIL-STD-1553B – ARINC 429 –ARINC 629.

MODULE IV FLIGHT DECKS AND COCKPITS: **7**

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – direct voice input (DVI)- civil and military cockpits: MFDS, HUD, MFK, HOTAS.

MODULE V AVIONICS SYSTEM (AIR DATA INSTRUMENTS & POWER PLANTS INSTRUMENTS) **8**

Air data instruments- Airspeed, altitude, vertical speed indicators- Angle of attack measurements- Pressure measurements- Temperature measurements, fuel quantity measurement, engine power and control instruments- measurements of RPM, EPR, fuel flow, engine vibration.

MODULE VI AVIONICS SYSTEMS(COMMUNICATION & NAVIGATIO INSTRUMENTS) **8**

Communications systems- Navigation systems – flight control systems – radar –electronic warfare – utility systems reliability and maintainability –certification.

Total Hours : 45

TEXT BOOKS:

Spitzer, C.R. “Digital Avionics Systems”, McGraw Hill, 1993.

Gaokar, R.S., “Microprocessors Architecture-Programming and Applications”, Wiley and Sons Ltd., New Delhi, 1990.

Pallet, E.H.J., “Aircraft Instruments & integrated systems”, Longman Scientific and Technical, McGraw Hill, 1992.

REFERENCES:

Middleton, D.H., Ed., “Avionics systems, Longman Scientific and Technical”, Longman Group UK Ltd., England, 1989.

Brain Kendal, “Manual of Avionics”, 3rd Edition, The English Book House, New Delhi,

OUTCOMES:

Students will be able to

- Identify the use of various avionics systems and their advantages over the conventional system.
- Gain knowledge of the operation of the microprocessor.
- Acquire knowledge of the communication protocol and architecture of avionics systems.
- Keep abreast of the basic principles, theory and operation of modern cockpit display systems.
- Differentiate between air data instruments and power plant instruments and their functioning for both civil and military aircraft.
- Acquire knowledge about the principles of various avionics systems like navigation, communication and electronic warfare.

AEB 4102 EXPERIMENTAL STRESS ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

To introduce the experimental methods of finding the responses of structural elements subjected to different types of loads.

MODULE I EXTENSOMETERS 8

Principles of measurement, Accuracy, Sensitivity and range of measurements- Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

MODULE II ELECTRICAL RESISTANCE STRAIN GAUGES 12

Principle of operation and requirements, 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.

MODULE III TRANSMISSION PHOTO ELASTICITY 7

Two dimensional photo elasticity, Concept of light, photo elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials.

MODULE IV THREE DIMENSIONAL PHOTO ELASTICITY AND DIGITAL PHOTO ELASTICITY 6

Three dimensional photo elasticity, Stress freezing, Slicing, Application to a complex problem, Integrated photo elasticity, Principle of optical equivalence.

MODULE V BRITTLE COATINGS AND MOIRE METHODS 5

Introduction to Moire Techniques, Brittle coating methods and holography

MODULE VI NON DESTRUCTIVE TESTING 7

Fundamentals of NDT, Radiography, Ultrasonic, magnetic particle inspection ,Fluorescent penetrant technique, Eddy current testing ,Acoustic Emission Technique, Thermograph, Fiber optic Sensors.

Total Hours: 45

TEXT BOOKS:

Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., “Experimental Stress Analysis”, Tata McGraw-Hill, New Delhi, 1984

Dally, J.W., and Riley, W.F., “Experimental Stress Analysis”, 4th Edition, McGraw-Hill Inc., New York, 2005.

REFERENCES:

Hetyenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc.,New York, 1972.

K. Ramesh, “Digital Photoelasticity – Advanced Techniques and Applications”, Springer, 2000.

Max Mark Frocht, “Photoelasticity”, illustrated Edition, Wiley & Sons Inc, 1968

Sadhu Singh, “Experimental Stress Analysis”, 2nd Edition, Khanna, 1990.

OUTCOMES:

Students will be able to,

- Differentiate and use the type of strain gauges suitable for different applications.
- Evaluate the structural responses using different experimental stress analysis techniques and compare with that of the analytical data
- Identify the areas of stress concentration on different types of structural elements using the photo elastic methods.
- Gain knowledge of 3D photo elasticity and digital photo elasticity.
- Use the Moiré techniques, brittle coating methods and holography wherever traditional methods cannot be used.
- Apply NDT methods for detecting the structural defects.

AEB 4103 **HEAT TRANSFER** **L T P C**
3 0 0 3

OBJECTIVES:

To introduce the heat transfer principles and the behavior of thermal systems.

To expose students to the governing differential and algebraic equations associated with thermal systems.

To expose students to the heat transfer applications in Aerospace industries.

MODULE I FUNDAMENTALS AND HEAT CONDUCTION **10**

conduction – convection – radiation, Steady and unsteady state heat conduction in solids - effect of variation of thermal conductivity on heat transfer in solids, conduction with heat generation, heat transfer problems in infinite and semi infinite solids, critical radius of insulation- extended surfaces, application of numerical techniques.

MODULE II FREE CONVECTION **8**

Basic equations, boundary layer concept, dimensional analysis, Laminar boundary layer equation, free convection in atmosphere free convection on a vertical flat plate, integral method, empirical relation in free convection – external flows.

MODULE III FORCED CONVECTION **6**

Forced convection, laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. empirical relations - numerical techniques in problem solving.

MODULE IV RADIATIVE HEAT TRANSFER **7**

Concept of black body-Intensity of radiation-Laws of black body radiation-radiation from non black surfaces, real surfaces, radiation between surfaces, radiation shape factors, radiation shields.

MODULE V HEAT EXCHANGERS **6**

Types-overall heat transfer coefficient- LMTD- NTU method of heat exchanger analysis.

MODULE VI HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING **8**

Heat transfer problems in gas turbine combustion chambers - rocket thrust chambers - aerodynamic heating - ablative heat transfer.

Total Hours: 45

TEXT BOOKS:

Yunus A. Cengel., "Heat Transfer – A practical approach", 2nd Edition, Tata McGraw-Hill, 2002.

Incropera. F.P.and Dewitt.D.P., "Introduction to Heat Transfer", John Wiley and Sons, 2002.

REFERENCES:

Lienhard, J.H., "A Heat Transfer Text Book", Dover publication, 2011.

Holman, J.P. "Heat Transfer", 6th Edition, McGraw-Hill Book Co., Inc., New York, 1991.

Sachdeva, R.C., "Fundamentals of Engineering Heat & Mass Transfer", New Age International, New Delhi, 2011.

OUTCOMES:

Students will be able to

- Differentiate the different modes of heat transfer in various media and solve the simple cases of conduction, convection and radiation using their governing equations.
- Apply the concept of free convection in the normal boundary layer flow over a vertical flat plate.
- Differentiate forced convection from free convection and solve the simple cases of forced convection using analytical as well as numerical techniques.
- Use the concept of black body to solve simple ideal cases of radiation using its governing equations.
- Apply the laws of heat transfer in the cases of heat exchangers of standard types.
- Apply the heat transfer concept and explain the problems involving heat transfer in the aerospace vehicles.

AEB 4104	AIRCRAFT DESIGN PROJECT – II	L	T	P	C
		1	0	3	2

OBJECTIVES:

To introduce the detailed design procedure to be adapted for the design of selected type of aircraft

Each student is assigned with work in continuation of the design project – I. The following sequence is to be carried out.

V-n diagram for the design study

Gust and maneuverability envelopes

Critical loading performance and final V-n graph calculation

Structural design study – theory approach

Load estimation of wings

Load estimation of fuselage.

Balancing and maneuvering loads on tail plane, aileron and rudder loads.

Detailed structural layouts

Design of some components of wings, fuselage

Preparation of a detailed design report with CAD drawings.

Total Hours: 45

OUTCOMES:

Students will be able to

Finalize the V-n diagram of the selected aircraft

Estimate the limiting loads on the aircraft during flight

Apply suitable design methods and design structural elements/ systems for a given aircraft

Prepare CAD drawings of the designed aircraft.

AEB 4105	AVIONICS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

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

LIST OF EXPERIMENTS:

DIGITAL ELECTRONICS

Addition/subtraction of binary numbers.

Multiplexer/demultiplexer circuits.

Encoder/decoder circuits.

Timer circuits, shift registers, binary comparator circuits.

MICROPROCESSORS

Addition and subtraction of 8-bit and 16-bit numbers.

Sorting of data in ascending & descending order.

Sum of a given series with and without carry.

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

Interface programming with 4 digit 7 segment display & switches & LED's.

16 channel analog to digital converter & generation of ramp, square, triangular wave by digital to analog converter.

AVIONICS DATA BUSES

Study of different avionics data buses.

MIL-Std – 1553 data buses configuration with message transfer.

MIL-Std – 1553 remote terminal configuration.

Total Hours: 45

OUTCOMES:

Student will be able to understand

The principle of operation of a variety of aircraft types and basic mechanics of flight, as well as sensors and systems onboard aircraft.

Application of problem solving methodologies in an avionics and aerospace context

Communication and coordination proficiently by listening, speaking, reading and writing for professional practice in the aerospace industry.

AEB 4106 CFD AND STRUCTURAL SIMULATION LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

To familiarize the students with the application of CFD/ CSM codes and their applications in aeronautics.

To train the students to compute the flow features and stress distributions over aircraft components.

LIST OF EXPERIMENTS:

CFD simulation of

Flow over an airfoil

Flow over a cone cylinder fuselage configuration

Free jet flow

Computational Structural Analysis of

Wing spar

Fuselage bulkhead

Total Hours: 45

OUTCOMES:

Students will be able to

Identify suitable computational domains, boundary conditions for simple flow problems

Select the appropriate meshing techniques and suitable solver for the flow problems

Simulate the flow around various configurations and interpret the results obtained

Analyse the structural response of different Aircraft structural components for various loads.

ELECTIVES

AEBX01 VISCOUS FLOWS **L T P C**
3 0 0 3

OBJECTIVES:

To introduce the basic idea of compressible and incompressible viscous flows and boundary layers.

MODULE I FUNDAMENTAL EQUATIONS OF COMPRESSIBLE VISCOUS FLOWS **6**

Classifications of fundamental equations, the equation of continuity, the Navier-stokes equation, the energy equation, boundary conditions for viscous heat-conducting flow; orthogonal coordinates system, mathematical character of the basic equations.

MODULE II SOLUTIONS OF THE NEWTONIAN VISCOUS-FLOW EQUATIONS **7**

Introduction and classifications of solutions, Couette flows, Poiseuille flow through ducts-circular pipes, combined Couette-Poiseuille flow non circular duct. Similarity solutions, low Reynolds number linearized motion.

MODULE III LAMINAR BOUNDARY LAYERS **7**

The laminar-boundary layer equations, flow separation, Similarity solutions for steady two-dimensional flows- Blasius solutions: Falkner-skan wedge flow,Free- shear flows, approximate integral methods, flow in the inlet of ducts.

MODULE IV INCOMPRESSIBLE TURBULENT MEAN FLOW **10**

Physical and mathematical description of turbulence, the Reynolds equations of turbulent motion, The two dimensional turbulent-boundary-layer equation, Velocity profiles: The inner, Outer, and overlap layers, Turbulent flow in pipes and channels, The turbulent boundary layer on a flat plate, Turbulence modeling.

MODULE V COMPRESSIBLE-BOUNDARY LAYER FLOW **7**

Introduction steady viscous flow, similarity solutions for compressible laminar flow, solutions for laminar flat plate flow ,integral relation for the compressible boundary layer, compressible law of the wall, compressible law of the wake, flat plate theory of van driest

MODULE VI TURBULENT FREE SHEAR FLOWS **8**

Equations for plane free shear layers, plane free jets: Global balance, far field, near field, wall effects, mixing layer, plane wake, axisymmetric free shear flows: basic equations, free jet, wake, Buoyant jets: plane boundary jets, axisymmetric buoyant jet, plane wall jet.

Total Hours: 45

TEXTBOOK:

Frank M.White, “Viscous fluid flow”, Tata McGraw Hill Publications, 2006

REFERENCE

Schlichting .H, “Boundary layer theory”, McGraw Hill Publications, Newyork.

OUTCOMES:

Students will be able to

- Express viscous flows in terms of partial differential equations along with appropriate boundary conditions.
- Perform calculations for the solution of Navier-Stokes equation for simple flows.
- Acquire knowledge of the solution of laminar boundary layers.
- Gain knowledge of turbulent boundary layers in the compressible and incompressible regimes.
- Perform simple boundary layer calculations using $1/7^{th}$ power law velocity profile.
- Apply the concept of free shear layers to jet flows.

AEBX02 HYPERSONIC AERODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

To introduce the basic concepts of hypersonic flows and their effects on flight vehicles

MODULE I FUNDAMENTALS OF HYPERSONIC AERODYNAMICS 7

Introduction to hypersonic aerodynamics, differences between hypersonic aerodynamics and supersonic aerodynamics, concept of thin shock layers, hypersonic flight paths, hypersonic Similarity parameters, shock wave and expansion wave relations of inviscid hypersonic flows.

MODULE II SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS 8

Local surface inclination methods, Newtonian theory, modified Newtonian law, tangent wedge and tangent cone methods, shock expansion methods, approximate theory-thin shock layer theory.

MODULE III VISCOUS HYPERSONIC FLOW THEORY 7

Boundary layer equation for hypersonic flow-hypersonic boundary layers, self-similar and non self-similar boundary layers, solution methods for non self-similar boundary layers aerodynamic heating.

MODULE IV VISCOUS INTERACTIONS IN HYPERSONIC FLOWS 7

Introduction to the concept of viscous interaction in hypersonic flows, strong and weak viscous interactions, hypersonic viscous interaction similarity parameter, introduction to shock wave boundary layer interactions.

MODULE V INTRODUCTION TO HIGH TEMPERATURE EFFECTS 8

Nature of high temperature flows, chemical effects in air-real and perfect gases-Gibb's free energy and entropy-chemically reacting mixtures-recombination and dissociation.

MODULE VI EXPERIMENTAL FACILITIES FOR HYPERSONIC FLOWS 8

Impulse facilities, hypersonic wind tunnels, shock tunnels, gun tunnels, and heat transfer measurements.

Total Hours: 45

TEXTBOOK:

John. D. Anderson. Jr., “Hypersonic and High Temperature Gas Dyanmics”, McGraw hill Series, New York, 1996.

REFERENCES:

John. D. Anderson. Jr ., “Modern compressible flow with historical perspective”, McGraw Hill Publishing Company, New York, 1996.

John. T Bertin, “Hypersonic Aerothermodynamics”, published by AIAA Inc.,Washington.D.C., 1994.

OUTCOMES:

Students will be able to:

- Differentiate between hypersonic and supersonic aerodynamics.
- Gain knowledge of simple solution methods to find the approximate solution for the inviscid hypersonic flows.
- Apply the viscous flow concept and solution methods for boundary layer and heating.
- Predict the viscous interaction.
- Gain knowledge of the effect of chemistry at high temperature.
- Acquire knowledge on various experimental facilities for hypersonic speeds.

AEBX03 INTRODUCTION TO CFD L T P C
3 0 0 3

OBJECTIVES:

To introduce the basic equations governing fluid flow problems and CFD techniques to solve them.

MODULE I GOVERNING EQUATIONS OF FLUID DYNAMICS 6

Equation for viscous flow - The Navier-stokes equation - Equations for Inviscid flow - The Euler's equation - physical boundary condition - Conservation forms.

MODULE II MATHEMATICAL BEHAVIOR OF PARTIAL DIFFERENTIAL EQUATIONS 7

Hyperbolic equations- steady inviscid supersonic flow; unsteady inviscid flow, parabolic equation- steady boundary layer flows, elliptic equations- steady subsonic inviscid flow; incompressible inviscid flow, supersonic blunt body problems, well-posed problems.

MODULE III BASICS OF DISCRETIZATION 5

Finite differences, Difference equations, Explicit and Implicit approaches - Error and stability analysis. Finite volume techniques, Errors and uncertainty.

MODULE IV GRID GENERATION 7

General transformation of the equations, Matrices and Jacobians, Stretched (Compressed) grids, Boundary- Fitted Coordinate System- elliptic grid generation, adoptive grids, modern development in grid generation, modern development finite volume grid generation; unstructured meshes.

MODULE V SIMPLE CFD TECHNIQUES 12

Solution of model equations- Heat equation, Wave equation, Laplace equations, The Lax-WendroffTechnique, MacCormack'sTechnique, Governing equations in Conservation form, Space marching, The relaxationTechnique and its use with low speed inviscid flow, Aspects of numerical dissipation and dispersion; Artificial viscosity, The Alternating – Direction –Implicit (ADI) technique the pressure correction Technique; Applications to incompressible viscous flow, Pressure correction formula, the SIMPLE algorithm, Boundary conditions for the pressure correction method.

MODULE VI APPLICATIONS **8**

Quasi- one- dimensional nozzle flow, Inviscid two- dimensional supersonic flow, Incompressible Couette flow, viscous supersonic flows over flat plate. Application to commercial CFD package-Inviscid flow simulation, viscous flow/ boundary layer simulations.

Total Hours: 45

TEXT BOOK:

John D. Anderson, Jr., “Computational Fluid Dynamics”, McGraw-Hill, Inc., 1995.

REFERENCES:

John C. Tannehill, Dale A. Anderson, Richard H. Pletcher, ” Computational fluid mechanics and Heat Transfer”, Special Indian Edition, Taylor Francis, 1997.

T. J. Chung, “Computational fluid Dynamics”, Cambridge University Press, UK 2013.

S.V Patankar , “Numerical heat transfer and fluid flow”, Hemisphere publishing Corp, Taylor & Francis group, Newyork, 1980.

P.Roach, “Fundamentals of computational fluid dynamics”, Hermosa,1999.

OUTCOMES:

Students will be able to

- Gain knowledge of flow governing equations and boundary conditions.
- Evaluate the mathematical behaviour of the relevant governing equations.
- Apply suitable discretization technique for the chosen problem.
- Gain knowledge on grid generation for the chosen problem.
- Identify and apply suitable numerical solution techniques.
- Make use of commercial solution packages.

AEBX04 HELICOPTER AERODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

To introduce the basic aerodynamic concepts involving helicopter flight.

MODULE I DEVELOPMENT OF ROTATING WING AIRCRAFT 6

Evolution of helicopter, Helicopter configurations, rotor arrangements, compound Helicopter - jet rotor, no tail rotor concepts.

MODULE II DYNAMICS OF HOVERING FLIGHT 10

Actuator disc theory, Blade Element Theory, ideal twist Induced & profile power, Figure of merit, Thrust and power coefficients, calculation of drag, torque, power-Ground effect in hover, Estimation of hover ceiling.

MODULE III DYNAMICS OF FORWARD FLIGHT 8

Forward flight performance, Parasite drag and Power, Stall limitations, flapping, cyclic Pitch; Autorotation in hover and in forward flight, Dead man's curve.

MODULE IV CLIMB AND DESCENT PERFORMANCE 8

Vertical flight, flow patterns surrounding the rotor-Power required in climb and descent,Descent speed calculations, Take-off techniques.

MODULE V HELICOPTER STABILITY AND CONTROL 7

Trim-Static stability, dynamic stability, Pilot's control, Rotor control, Flight control systems and stability argumentation, Flying qualities.

MODULE VI DYNAMIC STALL 6

Flow morphology, rotor environment, semi-empirical models, effects of sweep angle, varying velocity effects,stall control.

Total Hours: 45

TEXTBOOK:

Leishman. J. Principle of helicopter aerodynamics, Cambridge university press, 2006.

REFERENCES:

Gessow A & Myers G.C, “Aerodynamics of Helicopter” Mac Millan& Co, 1987

Saunders, “Dynamics of Helicopter flight”, John Wiley, 1975

Newman. S, “Foundation of Helicopter Flight”, Halsted Press, 1994

Seddon. J, “Basic Helicopter Aerodynamics”, AIAA education series, 2001.

W.Johnson, “Helicopter Theory”, Dover press, 1994.

OUTCOMES:

Students will be able to

- Acquire knowledge on helicopter rotor concepts and arrangements.
- Calculate flow parameters for hovering flight.
- Estimate forward flight performance.
- Carry out basic calculations of climb and descent performance.
- Gain knowledge on static and dynamic stability of helicopter flight.
- Apply semi-empirical models to calculate basic stall parameters.

AEBX05 INDUSTRIAL AERODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

To familiarize with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations.

MODULE I ATMOSPHERIC BOUNDARY LAYER 7

Atmospheric circulation, Local winds, Terrain types, Mean velocity profiles, Power law and logarithm law - wind speeds, Turbulence profiles, Roughness parameters, simulation techniques in wind tunnels

MODULE II VEHICLE AERODYNAMICS 8

Boundary layers and separation, Two dimensional wake and vortex formation-Strouhal and Reynolds numbers, Separation and reattachments, Power requirements and drag coefficients of automobiles, Effects of cut back angle, aerodynamics of trains.

MODULE III WIND ENERGY COLLECTORS 7

Horizontal and vertical axis machines, energy density of different rotors, Power Coefficient, Betz coefficient by momentum theory.

MODULE IV BUILDING AERODYNAMICS 8

Pressure distribution on low rise buildings, wind forces on buildings, Environmental winds in city blocks, special problems of tall buildings, building codes, ventilation and architectural aerodynamics

MODULE V FLOW INDUCED VIBRATIONS 8

Vortex shedding, lock & effects of Reynolds number on wake formation in turbulent flows across wind galloping-wake galloping-along wind galloping of circular cables-oscillation of tall structures and launch vehicles under wind loads-stall flutter.

MODULE VI AIR POLLUTANT DISPERSION 7

Effectiveness of dispersion, stack height and separation, air pollution control devices, filters, leaning by pulse-jet, scrubbers- particulate scrubbers, gaseous pollutant scrubbers, absorbers, vapour emissions, dust suppression, open burning, trench burning, air pollution.

Total Hours: 45

TEXTBOOKS

Scorer R.S, “Environmental Aerodynamics”, Ellis Harwood Ltd, England, 1978.

Sachs P ,“Wind Forces in Engineering”, Pergamon Press, 1988

Blevins R.D, “Flow Induced Vibrations”, Van Nostrand, 1990

REFERENCES:

Rose Mccallen, Fred Browand, James Rose, “The aerodynamics of heavy vehicle- Trucks, buses and trains” Springer Berlin Heidelperg Newyork,2004

Sovran, M(ed), “Aerodynamic drag mechanism of bluff bodies and road vehicles”, Plenum Press, N.Y, 1978

Calvert N.G, “Wind Power Principles”, Charles Griffin & Co London, 1979.

OUTCOMES:

Students will be able to

- Estimate various flow parameters of atmospheric boundary layer.
- Perform basic calculations in vehicle aerodynamics.
- Differentiate the working of different wind energy collectors.
- Calculate wind forces on buildings.
- Apply the concepts of flow induced vibrations to solve basic problems.
- Acquire knowledge of various air pollutant dispersion techniques.

AEBX06 THEORY OF VIBRATIONS L T P C
3 0 0 3

OBJECTIVES:

To provide theoretical background to vibration of mechanical systems and analysis

MODULE I INTRODUCTION 9

Free and forced vibrations, degrees of freedom, simple harmonic motion, spring mass system, torsional vibration, Equation of motion, D'Alembert's Principle, conservation of energy.

MODULE II SINGLE DEGREE OF FREEDOM SYSTEMS 8

free vibrations, damped vibrations, forced Vibrations, with and without damping, support excitation, vibration measuring instruments.

MODULE III MULTI DEGREES OF FREEDOM SYSTEMS 7

Two degrees of freedom systems, static and dynamic couplings, principal co-ordinates, principal modes and orthogonal condition, Eigen value problems, Hamilton's principle, Lagrangean equations and application.

MODULE IV CONTINUOUS SYSTEMS 7

Vibration of elastic bodies, vibration of strings, longitudinal, lateral and torsional vibrations.

MODULE V APPROXIMATE METHODS 6

Approximate methods, Rayleigh's method, Dunkerlay's method, Rayleigh-Ritz method, matrix Iteration method.

MODULE VI VIBRATION MEASUREMENT AND CONTROLS 8

Vibration Transducers, Vibration pickups, Vibration exciters, balancing of rotating machines, vibration isolation, vibration obsorber.

Total Hours: 45

TEXT BOOKS:

Timoshenko S., "Vibration Problems in Engineering", Wolfender press, New York, 2008.

Fung Y.C., “An Introduction to the Theory of Aero elasticity”, Dover Publications, 2008.

REFERENCES:

Bisplinghoff R.L., Ashely H and Hogman R.L., “Aeroelasticity”, Dover Publications, 1996.

Tse. F.S., Morse, I.F., Hunkle, R.T., “Mechanical Vibrations Theory and Applications”, Allyn and Bacon, 1978

Benson H.Tongue, “Principles of Vibration”, Oxford University Press, 2000.

Singiresu S. Rao, “Mechanical Vibrations”, Addison- Wesley Publishing Company, 1995.

OUTCOMES:

Student will be able to

- Calculate natural frequency and period of simple vibrating mechanical systems
- Construct simple vibration models of mechanical systems and perform time- and frequency-domain vibration analysis for SDOF and MDOF**.**
- Estimate the vibrations of continuous systems: bars, beams and plates.
- Apply approximate methods for vibrations of continuous systems.
- Gain knowledge on various vibration measuring devices and controls.

AEBX07 THEORY OF PLATES AND SHELLS L T P C
3 0 0 3

OBJECTIVES:

To introduce the behavior of plates and shells with different geometry under various types of loads

MODULE I CLASSICAL PLATE THEORY 10

Plates as structural elements, stress and moment resultants, assumptions made in the classical theory, displacement fields and strains, boundary conditions, bending of rectangular plates with various boundary conditions and loading, limitations of classical theory, plates of various shapes

MODULE II BUCKLING ANALYSIS OF RECTANGULAR PLATES 8

Buckling of simply supported plates under compressive forces, Navier solution, biaxial compression of a plate, uniaxial compression of a plate buckling of plates simply supported on two opposite edges, Levy's solution, buckling of plates with various boundary conditions, general formulation.

MODULE III SHELLS 6

Basic concepts of shell like structure, membrane and bending stresses for circular, cylindrical and conical shells.

MODULE IV STABILITY ANALYSIS 6

Stability analysis of rectangular plates, Stability analysis of different types of shells equilibrium methods and energy methods applied to rectangular plates.

MODULE V VIBRATIONAL ANALYSIS 6

Vibration and transient analysis of rectangular plates subjected to different boundary conditions ,vibration of shells.

MODULE VI APPROXIMATEMETHODS 9

Rayliegh- Ritz method – Galerkein Method – Finite Difference Method - Application to rectangular plates and different types of shells

Total Hours: 45

TEXT BOOKS:

Timoshenko, S. and Krieger S.W., “Theory of Plates and Shells”, McGraw Hill Book Company, New York 1990.

Reddy,J.N., “Theory and Analysis of Elastic Plates & Shells”, 2nd Edition, C.R.C.Press, NY, USA,

REFERENCES BOOKS:

Szilard, R., “Theory and Analysis of Plates”, Prentice Hall Inc., 1995

Wilhelm Flügge, “Stresses in Shells”, Reprint Edition, Springer – Verlag,1962.

OUTCOMES:

Students will be able to

- Apply the principles of plate theory to solve problems involving plate as a structural element.
- Obtain the analytical solutions for the buckling of rectangular plates.
- Acquire knowledge on the structural behavior of shells.
- Analyze stability problems of plate and shell structures.
- Analyze vibration problems of plate and shell structures
- apply approximate methods to obtain solutions for equations of plates and shells.

AEBX08 FATIGUE AND FRACTURE L T P C
3 0 0 3

OBJECTIVES:

To introduce the mechanisms involved in failure of components due to fatigue and fracture.

MODULE I PLANE ELASTICITY 6

In plane and out of plane problems, Airy's Stress Function, Plates with circular and elliptical hole.

MODULE II PHYSICAL ASPECTS OF FATIGUE 5

Phase in fatigue life, Crack initiation, Crack growth , Final Fracture, Dislocations, Fatigue fracture surfaces.

MODULE III FATIGUE OF STRUCTURES 10

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.

MODULE IV STATISTICAL ASPECTS OF FATIGUE BEHAVIOR 8

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.

MODULE V FRACTURE MECHANICS 10

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.

MODULE VI FATIGUE AND FRACTURE DESIGN AND TESTING 6

Safe life and Fail-safe design philosophies, Importance of Fracture Mechanics in aerospace structures - Applica¬tion to composite materials and structures.

Total Hours: 45

TEXT BOOKS:

Prashant Kumar, “Elements of Fracture Mechanics”, Tata McGraw Hill, New Delhi, India, 2009.

Barrois W, Ripley, E.L., “Fatigue of Aircraft Structure”, Pegamon press. Oxford, 1983.

REFERENCES

K. R.Y.Simha, “Fracture Mechanics for Modern Engineering Design”, Universities Press (India) Limited, 2001

D.Broek, “Elementary Engineering Fracture Mechanics”, Kluwer Academic Publishers, Dordrecht, 1986.

T.L.Anderson, “Fracture Mechanics - Fundamentals and Applications”, 3rd Edition, Taylor and Francis Group, 2005.

Suresh. S., “Fatigue of Materials” , 2nd Edition, Cambridge University Press, 1998

OUTCOMES:

Students will be able to

- Solve the plane elasticity problems related to fatigue and fracture
- Identify the different phases in fatigue life of structures.
- Evaluate the fatigue life of structures theoretically.
- Evaluate the strength of cracked bodies.
- Analyze the stress of the cracked bodies and their intensities for different geometries.
- Apply the theories for predicting the fracture life of aerospace structures and composite materials.

AEBX09 FINITE ELEMENT METHOD L T P C
3 0 0 3

OBJECTIVES:

To introduce the concept of finite element analysis of structural components

MODULE I INTRODUCTION 6

Basic steps in fem, Solution of differential equations using weighted residual methods, Rayleigh and Ritz Method, Convergence criteria of finite element method.

MODULE II DISCRETE ELEMENTS 8

1 D elements, Bar elements (both Mechanical and thermal Loading), Beam element, Use of local and natural coordinates, Truss Analysis.

MODULE III CONTINUUM ELEMENTS 10

Constant and linear strain triangular elements, Plane stress, Plane strain, Axisymmetric problems.

MODULE IV ISOPARAMETRIC ELEMENTS 7

Mapping of Elements, shape function for quadrilateral elements, stiffness matrix, consistent load vector, Serendipity elements, Gaussian integration

MODULE V FIELD PROBLEMS 6

Heat transfer problems, steady state fin problems, torsion problems, Flow Field Problems.

MODULE VI VIBRATION ANALYSIS 8

Single degree of Freedom , Multiple degrees of Freedom System, Transverse vibrations of strings, Longitudinal, Lateral and Torsional vibrations

Total Hours: 45

TEXT BOOKS:

J.N. Reddy, “An Introduction to Finite Element Method”, 3rd Edition, Tata McGraw Hill, 2006.

Chandrupatla and Belegundu, “Introduction to Finite Elements in Engineering”, 4th Edition(revised), Pearson Education, 2011.

REFERENCE BOOKS:

Seshu. P., “Textbook of Finite Element Analysis”, Illustrated Reprint, Prentice Hall of India Learning Pvt Ltd., 2003.

R. D. Cook., “Concepts and Applications of Finite Element Analysis”, 2nd Edition, Wiley, 1981.

David V. Hutton., “Fundamentals of Finite Element Analysis”, Tata McGraw Hill, 2005.

S.S. Rao, “Finite Element Analysis”, 4th Edition, Elsevier Butterworth Heinemann, 2011

O. C. Zienkiewicz and Y.K. Cheung., “The Finite Element Method: Its Basis and Fundamentals”, 6th Edition (Reprint), Butterworth Heinemann, 2005.

G Lakshmi Narasiah., “Finite Element Analysis”, Illustrated Edition, B S publications, 2009.

OUTCOMES:

Students will be able to

- Apply weighted residual methods to solve differential equations.
- Obtain finite element equations for 1D problems and solve the structural problems.
- Obtain finite element equations for 2D problems and solve the structural problems.
- Use mapping of elements and formulate shape functions for different types of elements.
- Obtain finite element equations and solve problems involving fluid flow and heat transfer.
- Obtain finite element equations and solve problems involving for vibration analysis.

AEBX10 COMPOSITE MATERIALS AND STRUCTURES L T P C
3 0 0 3

OBJECTIVES:

To introduce the methods of fabrication and analysis of composite materials and structures.

MODULE I INTRODUCTION 7

Introduction – Advantages and applications of composite materials, reinforcements and matrices- type of resins properties and applications – generalized Hooke's law – elastic constants for anisotropic, orthotropic and isotropic materials.

MODULE II MICROMECHANICS 8

Micromechanics – mechanics of material approach and elasticity approach to determine the material properties - fibre volume ratio - Mass Ratio - effects of voids and hygrothermal effects of lamina.

MODULE III MACROMECHANICS 9

Macro mechanics – Stress Strain relations with respect to natural and arbitrary axis – Determination of material properties – Experimental characterization of lamina.

MODULE IV LAMINATED PLATES 10

Governing differential equation for a unidirectional lamina and general laminate, angle ply, cross ply laminates – failure criteria for composites.

MODULE V SANDWICH CONSTRUCTIONS 5

Basic modes of sandwich construction – materials used for sandwich construction – failure modes of sandwich panels.

MODULE VI FABRICATION PROCESS 6

Various open and closed mould processes – Manufacture of fiber – netting analysis – autoclave – vacuum bag molding – filament winding – pultrusions – resin transfer molding.

Total Hours: 45

TEXT BOOKS:

Jones, R.M., “Mechanics of Composite Materials”, 2nd Edition, Taylos & Francis group, 1999.

Authar K Kaw., “Mechanics of Composite Materials”, 2nd Edition, CRC press, 2010.

REFERENCES:

Madhuji Muhkapadhyay., “Mechanics of composite Materials and structures”, Illustrated Edition, University press, 2004.

Calcote, L R., “The Analysis of laminated Composite Structures”, Von – Noastrand Reinhold Company, New York 1998.

Agarwal, B.D., and Broutman, L.J., “Analysis and Performance of Fibre Composites”, John Wiley and sons. Inc., New York, 1995.

Allen Baker., “Composite Materials for Aircraft Structures”, 2nd Edition, AIAA series, 1999.

OUTCOMES:

Students will be able to

- Identify and relate the properties of the components and their functions in a composite material.
- Calculate the mechanical properties of an unidirectional composite ply
- Apply the appropriate fabrication process involved in developing the composite structures.
- Calculate the mechanical properties of laminated plates.
- Apply suitable failure criteria to composite lamina and extend the theory to laminated composite plates.
- Select different modes of sandwich construction and various fabrication processes.

AEBX11 AEROELASTICITY L T P C
3 0 0 3

OBJECTIVES:

To provide necessary background on the fluid-structure interaction and the aeroelastic phenomena involved in such interactions.

MODULE I INTRODUCTION 10

Aero elastic problems – Influence functions and Influence co efficient – Generalized Co ordinates and Lagrange's equation, General solutions for equation of motions with mode shapes for uniform string, Beam bending, beam torsional dynamics.

MODULE II AEROELASTIC EQUATIONS AND THEIR SOLUTIONS 8

Aeroelastic operators and their Manipulations, Classification of the Equations of Aeroelasticity, Methods to Solve the Equations of Aeroelasticity

MODULE III STATIC AEROELASTICITY 8

Divergence of 2D airfoil and Straight wing, Aileron Reversal, Control effectiveness, Wind Divergence, Swept wing

MODULE IV DYNAMIC AEROELASTICITY 5

Dynamics of typical section of airfoil (Sinusoidal, Periodic, Arbitrary and random motions)

MODULE V UNSTEADY AERODYNAMICS 6

2D and 3D supersonic flow, Determination of kernel's function for subsonic flow, Theoderson's unsteady thin airfoil theory, and finite state unsteady thin airfoil theory.

MODULE VI FLUTTER 8

Aero elasticity analysis of a typical section of airfoil, classical flutter analysis (2 degrees of freedom and 3 degrees of freedom), Engineering Solutions for flutter (k method and p – k method)

Total Hours: 45

TEXT BOOKS:

D.H. Hodges and G.A. Pierce, "Introduction to Structural Dynamics and Aeroelasticity" Cambridge Aerospace Series, 2002.

R.L. Bisplinghoff and H. Ashley, "Principles of Aeroelasticity", Dover, 1962

REFERENCES:

Y .C Fung., “Introduction to the Theory of Aeroelasticity”, Illustrsted Reprint, Courier Dove Publications, 2002.

R.H. Scanlan and R. Rosenbaum, "Introduction to the study of Aircraft Vibration and Flutter" Macmillan, 1951.

V.V. Bolotin., "Nonconservative Problems of the Elastic Theory of Stability", Pergamon Press, 1963.

OUTCOMES:

Students will be able to

- Identify aeroelastic problems and their effect on the motion of structural members.
- Obtain the equations for different aeroelastic phenomena and to solve those equations.
- Formulate aeroelastic motions mathematically and apply them for the static analysis.
- Formulate aeroelastic motions mathematically and apply them for the dynamic analysis.
- Acquire knowledge of the effect of unsteady aerodynamics on structural behavior of thin walled membrane structures
- Apply Engineering solutions for the flutter analysis of elastic structures using different methods.

AEBX12	BEHAVIOR OF MATERIALS AT HIGH TEMPERATURES	L T P C 3 0 0 3

OBJECTIVE:

To introduce the effect of high temperatures on the behavior of materials and material properties

MODULE I CREEP **12**

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate, Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.

MODULE II FRACTURE **9**

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

MODULE III OXIDATION **5**

Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation, defect structure and control of oxidation by alloy additions,

MODULE IV HOT CORROSION **7**

Hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods to combat hot corrosion.

MODULE V SUPERALLOYS **7**

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

MODULE VI ABLATION **5**

Ablative materials, Applications, Advantages and Disadvantages, Ablative heat transfer.

Total Hours: 45

TEXT BOOKS:

Hertzberg R. W., “Deformation and Fracture Mechanics of Engineering materials”, 4th Edition, John Wiley, USA, 1996.

Courtney T.H, “Mechanical Behavior of Materials”, McGraw-Hill, USA, 1990.

REFERENCES:

Bressers. J., “Creep and Fatigue in High Temperature Alloys”, Applied Science, 1981.

Raj. R., “Flow and Fracture at Elevated Temperatures”, American Society for Metals, USA, 1985.

Boyle J.T, Spencer J, “Stress Analysis for Creep”, Butterworths, UK, 1983.

McLean D., “Directionally Solidified Materials for High Temperature Service”, The Metals Society, USA, 1985.

OUTCOMES:

Students will be able to

- Identify factors influencing functional life of components at elevated temperatures.
- Evaluate fracture mechanism types and Interpret data from fracture maps of different alloys.
- Apply laws of oxidation.
- Depict hot gas corrosion methods and suggest methods to combat hot corrosion.
- Gain knowledge of the role of super alloys in high temperature applications.
- Comprehend ablative heat transfer phenomenon and suggest suitable ablative materials for space applications.

AEBX13 ROCKET PROPULSION L T P C
3 0 0 3

OBJECTIVES:

To introduce different types of propellants for rocket propulsion and the study of system performance

MODULE I CLASSIFICATION AND FUNDAMENTAL OF ROCKET PROPULSION 7

Duct Jet Propulsion, Rocket Propulsion, Applications of Rocket Propulsion Thrust, Exhaust Velocity, Energy and Efficiencies, Typical Performance Values, Nozzle Configurations, Nozzle performance parameters

MODULE II LIQUID PROPELLANT ROCKET ENGINE FUNDAMENTALS 7

Propellants, Propellant Feed Systems, Gas Pressure Feed Systems, Propellant Tanks, Tank Pressurization, Turbopump Feed Systems and Engine Cycles, Flow and Pressure Balance

MODULE III LIQUID PROPELLANTS AND COMBUSTION 8

Propellant Properties, Liquid Oxidizers, Liquid Fuels, Liquid Monopropellants, Gelled Propellants, Gaseous Propellants, Safety and Environmental Concerns, Thrust Chambers, Injectors, Injectors flow characteristics, Combustion Process, Combustion Instability.

MODULE IV SOLID PROPELLANT ROCKET FUNDAMENTALS 7

Propellant Burning Rate, Basic Performance Relations, Propellant Grain and Grain Configuration, Propellant Grain Stress and Strain.

MODULE V SOLID PROPELLANTS AND COMBUSTION 9

Classification, Propellant Characteristics, Hazards, Propellant Ingredients, Other Propellant Categories Liners, Insulators, and Inhibitors, Combustion of Solid Propellants, Physical and Chemical Processes, Ignition Process, Extinction or Thrust Termination, Combustion Instability.

MODULE VI THRUST VECTOR CONTROL **7**

TVC Mechanisms with a Single Nozzle, TVC with Multiple Thrust Chambers or Nozzles Testing Integration with Vehicle, Attitude Control and Side Maneuvers with Solid Propellant Rocket Motors

Total Hours: 45

TEXTBOOK:

George P. Sutton, Oscar Biblarz, “Rocket Propulsion Elements”, 7th Edition, John-Wiley & Sons, Ltd., 2001.

REFERENCES:

R. Humble, G. Henry, and W. Larson, “Space Propulsion Analysis and Design”, McGraw-Hill, New York, 1995.

Hill, Philip and Carl Peterson, “Mechanics and Thermodynamics of Propulsion”, Prentice Hall, 1991.

OUTCOMES:

Students will be able to

- Evaluate performance parameters for rocket engines and nozzles
- Acquire knowledge about different feed systems of liquid propellant rocket engine.
- Identify different liquid propellant types and gain knowledge about their combustion phenomena.
- Analyze solid rocket motor performance parameters and propellant grain structure.
- Acquire knowledge about ballistic properties of solid propellants and combustion kinetics.
- Identify the mechanisms involved in thrust vector control.

AEBX14 TURBOMACHINERY AERODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

To introduce the aerodynamic behavior of turbomachinery devices and their components in Gas turbine engines

MODULE I INTRODUCTION TO TURBOMACHINERIES 5

General fluid dynamics governing equations, Classification of turbomachines-thermodynamic analysis - efficiency – dimensional analysis, Elementary Airfoil theory, Euler's Turbomachinery equations

MODULE II AXIAL FLOW COMPRESSORS AND FANS 12

Aero-Thermodynamics of flow through an axial flow compressor stage, Losses in axial flow compressor stage, Losses and Blade performance estimation, Secondary flows (3-D), Tip leakage flow and scrubbing, Simple three dimensional flow analysis.

Design of compressor blades, 2-D blade section design : Airfoil Data, Axial Flow Track Design, Axial compressor characteristics, Multi-staging of compressor characteristics, Transonic Compressors, Shock Structure Models in Transonic Blades, Transonic Compressor Characteristics, 3-D Blade shapes of Rotors and Stators, Instability in Axial Compressors, Loss of Pressure Rise, Loss of Stability Margin, Noise problem in Axial Compressors and Fans.

MODULE III AXIAL FLOW TURBINES 9

Introduction, Turbine stage, Turbine Blade 2-D (cascade) analysis Work Done, Degree of Reaction, Losses and Efficiency, Flow Passage, Subsonic - transonic and supersonic turbines, Multi-staging of Turbine, Exit flow conditions, Turbine Cooling, Turbine Blade design – Turbine Profiles : Airfoil Data and Profile construction.

MODULE IV CENTRIFUGAL COMPRESSORS 7

Introduction, Elements of centrifugal compressor/ fan, Inlet Duct Impeller, Slip factor, Concept of Rothalpy, Modified work done, Incidence and lag angles, Diffuser , Centrifugal Compressor Characteristics, Surging, Chocking, Rotating stall, Design

MODULE V RADIAL TURBINE **6**

Introduction, Thermodynamics and Aerodynamics of Radial turbines, Radial Turbine Characteristics, Losses and efficiency, Design of radial turbines

MODULE VI USE OF CFD FOR TURBOMACHINERY ANALYSIS AND DESIGN **6**

Computer aided blade profile generation, Cascade Analysis, Periodicity and boundary conditions, 3-D blade generation and 3-D flow analysis, Flow track and inter-spool duct analysis and design.

Total Hours: 45

TEXT BOOKS:

B Lakshminarayana, “Fluid Mechanics and Heat Transfer in turbomachineries”, 1st Edition Wiley-Interscience, USA, 1995.

Oates Gordon C,Â Aerothermodynamics of Aircraft Engine Components, AIAA series, 1985.

REFERENCES:

Mattingly J. D., “Elements of Gas Turbine Propulsion”, Tata McGraw Hill, 2005.

Ganesan V., “Gas Turbines”, 3rd Edition, McGraw Hill, 2010.

Nicholas Cumpsty, “Compressor Aerodynamics”, Kreiger Publications, USA, 2004.

Ahmed F. El-Sayed, “Aircraft Propulsion and Gas Turbine Engines”, CRC press, 2008.

El-Wakil, M M, “Powerplant Technology”, McGraw-Hill Pub., 1984.

J H Horlock, “Axial flow compressors”, Butterworths, UK, 1958.

OUTCOMES:

Students will be able to

- Express the flow through Turbomachines in terms of governing equations of fluid dynamics.
- Perform the blade design calculations and loss estimations of axial flow compressors and fans.
- Carry out axial turbine performance and blade design calculations.
- Analyse the performance of centrifugal compressors.
- Perform simple design calculations of radial turbines.
- Apply CFD techniques for blade profile generation and flow analysis.

AEBX15 COMBUSTION L T P C
3 0 0 3

OBJECTIVES:

To introduce the basic principles of combustion thermodynamics in different types of aerospace powerplants

MODULE I FUNDAMENTAL CONCEPTS IN COMBUSTION 5

Thermo – chemical equations, Heat of reaction – first order, second order and third order reactions, premixed flames, diffusion flames

MODULE II CHEMICAL KINETICS AND FLAMES 5

Measurement of burning velocity – various methods – effect of various parameters on burning velocity, flame stability, deflagration, detonation, Rankine-Hugoniot curves, radiation by flames

MODULE III COMBUSTION IN AIRCRAFT PISTON ENGINES 7

Introduction to combustion in aircraft piston engines ,various factors affecting the combustion efficiency , fuels used for combustion in aircraft piston engines and their selection, detonation in piston engine combustion and the methods to prevent the detonation

MODULE IV COMBUSTION IN GAS TURBINE AND RAMJET ENGINES 10

Combustion in gas turbine combustion chambers - recirculation – combustion efficiency - factors affecting combustion efficiency - fuels used for gas turbine combustion chambers, combustion stability, ramjet combustion, differences between the design of ramjet combustion chambers and gas turbine combustion chambers, flame holders types, numerical problems.

MODULE V SUPERSONIC COMBUSTION 9

Introduction to supersonic combustion – need for supersonic combustion for hypersonic airbreathing propulsion, supersonic combustion controlled by diffusion, mixing and heat convection – analysis of reactions and mixing processes, supersonic burning with detonation shocks, various types of supersonic combustors.

MODULE VI COMBUSTION IN SOLID, LIQUID AND HYBRID ROCKETS **9**

Solid propellant combustion - double and composite propellant combustion – various combustion models, combustion in liquid rocket engines – single fuel droplet combustion model, combustion hybrid rockets

Total Hours: 45

TEXT BOOKS:

Sharma, S.P., and Chandra Mohan, “Fuels and Combustion”, Tata McGraw Hill, Publishing Co., Ltd., New Delhi, 1987.

Sutton, G.P., “Rocket Propulsion Elements”, 5th Edition, John Wiley & Sons Inc., New York, 1993.

REFERENCES:

Loh, W.H.T., “Jet, Rocket, Nuclear, Ion and Electric Propulsion: Theory and Design”, Springer Verlag, New York, 1982.

Mathur, M.L., and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers and Distributors, Delhi, 1988.

Beer, J.M., and Chiger, N.A. “Combustion Aerodynamics”, Applied Science Publishers Ltd., London, 1981.

Turns, S. R., “An Introduction to Combustion Concepts and Applications”, 2nd Edition, McGraw Hill International Editions, New Delhi, 2000.

OUTCOMES:

Students will be able to

- Apply the basics of chemical kinetics to deal with combustion products.
- Explore different flame types and their characteristics.
- Select suitable fuels and analyse combustion intricacy of piston engines
- Select suitable fuels and analyse combustion intricacy of jet engines.
- Familiarize with supersonic combustion
- Comprehend all types of rocket engine combustion systems.

AEBX16 ADVANCED PROPULSION L T P C
3 0 0 3

OBJECTIVES:

To introduce the concepts of advanced propulsion systems applied for propelling flight vehicles within and beyond atmosphere

MODULE I PROPULSION FUNDAMENTALS AND OVERVIEW OF GAS DYNAMICS 6

Operational Envelopes, standard atmosphere, Air-breathing Engines Overview, Aircraft performance, Rocket Engines, H-K diagram, Normal shock wave, Flow with heat addition, flow with friction

MODULE II RAMJET ENGINES AND AIR AUGMENTED ROCKETS 6

Ideal and Actual Ramjet engine cycle analysis - Preliminary performance calculations – Diffuser design and hypersonic inlets – combustor and nozzle design – Air augmented rockets – Engines with supersonic combustion

MODULE III SCRAMJET PROPULSION SYSTEMS 11

Ramjet and Scramjet engine cycle analysis, Fundamental considerations of hypersonic air breathing vehicles – Preliminary concepts in engine airframe integration – calculation of propulsion flow path – flowpath integration – Various types of supersonic combustors – fundamental requirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow – performance estimation of supersonic combustors.

MODULE IV NUCLEAR PROPULSION SYSTEMS 8

Fission propulsion, Radioisotope Nuclear Rocket, Fusion propulsion, Antimatter propulsion

Nuclear rocket engine design and performance – nuclear rocket reactors – nuclear rocket nozzles – nuclear rocket engine control, Fission propulsion, Fusion propulsion, radioisotope propulsion – basic thruster configurations – thruster technology – heat source development – nozzle development – nozzle performance of radioisotope propulsion systems.

MODULE V ELECTRIC PROPULSION SYSTEMS 8

Basic concepts in electric propulsion, Power requirements and rocket

efficiency, Electrothermal thrusters – Resistojet, Arcjet, Solar/Laser/Microwave thermal propulsion, Electrostatic thrusters – Hall Thruster, Field emission thruster, Colloid thruster, Large accelerated plasma Propulsion – current and future trends, Fundamentals of ion propulsion – performance analysis – electrical thrust devices – Ion rocket engine, Electromagnetic thrusters – MPD thruster, PPT, VASIMR, Induced spacecraft Interactions

MODULE VI ADVANCED PROPULSION CONCEPTS 6

Concepts of Micropropulsion – chemical propulsion, electrical propulsion, Propellantless propulsion – Tethers, Propellantless electric/nuclear propulsion, Photon Rocket, Beamed Energy Earth-to-Orbit Propulsion, Solar sails, Magnetic sails, Breakthrough propulsion

Total Hours: 45

TEXT BOOKS:

Martin Tajmar, “Advance space Propulsion systems”, 1st Edition, Springer; Softcover reprint of the original, 2003.

William H. Heiser and David T. Pratt, “Hypersonic Airbreathing propulsion”, AIAA Education Series, 2001.

Corin Segal, “The scramjet engine – Processes and characteristics”, Cambridge University Press, 2009

REFERENCES:

Curran E.T., S. N. B. Murthy, Paul Zarchan (Editor-in-Chief), “Scramjet Propulsion”, Progress in Aeronautics and Astronautics, Volume 189, AIAA, 2001

G.P. Sutton, “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 1998.

Fortescue and Stark, “Spacecraft Systems Engineering”, 1999.

Cumpsty, “Jet propulsion, Cambridge”, University Press, 2003.

OUTCOMES:

Students will be able to

- Get an overview of jet engines and gas dynamics fundamentals.
- Perform calculations on the performance of ram jet engine, augmented rockets.
- Carry out performance estimation of supersonic combustors.
- Acquire knowledge about different nuclear propulsion systems.
- Acquire knowledge about different electrical propulsion systems and do performance analysis.
- Keep abreast of advanced / breakthrough propulsion systems.

AEB X17 ROCKETS AND MISSILES L T P C
3 0 0 3

OBJECTIVES:

To introduce the principles of design, development, operation and flight of rockets and missiles

MODULE I SOLID ROCKET SYSTEMS 6

Introduction - Rockets - purpose – classifications – components – functions, Solid-fuel rockets – basic concepts, design, solid propellants, Grain geometry, Casing, Nozzle, Performance

MODULE II LIQUID ROCKET SYSTEMS 8

Ignition system in rockets – types of igniters and igniter design considerations – injection system and propellant feed systems of liquid rockets and their design considerations – design considerations of liquid rocket thrust chambers – combustion mechanisms

MODULE III AERODYNAMICS OF ROCKETS AND MISSILES 9

Airframe components of rockets and missiles – forces acting on a missile while passing through atmosphere – classification of missiles – slender body aerodynamics- method of describing forces and moments – lift force and lateral moment –lateral aerodynamic damping moment – longitudinal moment – drag estimation – body upwash and body downwash in missiles – rocket dispersion.

MODULE IV ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD 8

One dimensional and two-dimensional rocket motions in free space and homogeneous gravitational fields – description of vertical, inclined and gravity turn trajectories – determination of range and altitude – simple approximations to burn out velocity and altitude – estimation of culmination time and altitude.

MODULE V STAGING AND CONTROL OF ROCKETS AND MISSILES 8

Design philosophy behind multistaging of launch vehicles and ballistic missiles – multistage vehicle optimization – stage separation techniques in atmosphere and in space – stage separation dynamics and lateral separation characteristics – various types of thrust vector control methods including secondary injection thrust vector control – numerical problems on stage separation and multistaging.

MODULE VI MATERIALS FOR ROCKET AND MISSILE APPLICATIONS **6**

Selection criteria of materials for rockets and missiles – materials for various airframe components and engine parts – materials for thrust control devices – various adverse conditions faced by aerospace vehicles and the requirement of materials to perform under these conditions.

Total Hours: 45

TEXT BOOKS:

Cornelisse, J.W., Schoyer H.F.R., Wakker K.F., “Rocket Propulsion and Space Dynamics”, Pitman Publishing, 1979

Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons, 2000.

Chin, S. S., “Missile configuration Design”, McGraw-Hill, 1961.

Parker, E.R., “Material for Missiles and Spacecraft”, McGraw Hill Book Co. Inc., 1982.

REFERENCES:

Barrere et al, “Rocket propulsion”, Elsevier publisher Co., 1960.

Martin J. L. Turner, “Rocket and Spacecraft propulsion: Principles, Practice & New Developments”, Springer Praxis, 2004.

N. Nielsen, “Missile Aerodynamics”, Mountain View, Near, Inc., 1998.

OUTCOMES:

Students will be able to

- Identify the various parts of a solid rocket propellant and propellant grain geometry.
- Acquire knowledge of the ignition and feed systems of the liquid rocket and their design parameters.
- Apply the law of aerodynamics on the flight performance of the rockets and missiles.
- Solve the rocket performance related problems and find the range and altitude gained in the ideal conditions.
- Recognize various types of multi-staging in the rockets and distinguish their separation techniques.
- Differentiate the various materials used in the rockets and missiles.

AEBX18	AIR TRAFFIC CONTROL AND AERODROME DESIGN	L T P C 3 0 0 3

OBJECTIVE:

To introduce the procedures of for air traffic services and navigations

MODULE I BASIC CONCEPTS **9**

Objectives of ATS - parts of ATC service – scope and provision of ATCs – VFR IFR operations – classification of ATS air spaces – varies kinds of separation – altimeter setting procedures – establishment, designation and identification of units providing ATS – division of responsibility of control.

MODULE II AIR TRAFFIC SERVICES **9**

Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – vertical, lateral and longitudinal separations based on time / distance –ATC clearances – flight plans – position report

MODULE III FLIGHTINFORMATION ALERTING SERVICES, COORDINATION **5**

Radar service, basic radar terminology – identification procedures using primary / secondary radar – performance checks use of radar in area and approach control services

MODULE IV EMERGENCY PROCEDURES AND RULES OF THE AIR **5**

Glide path assurance control and co-ordination between radar / non radar control – emergencies – flight information and advisory service – alerting service– co-ordination and emergency procedures – rules of the air

MODULE V AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION **9**

Aerodrome data - basic terminology – aerodrome reference code – aerodrome reference point – aerodrome elevation – aerodrome reference temperature – instrument runway, physical characteristics; length of primary / secondary runway – width of runways – minimum distance between parallel runways etc. – obstacles restriction.

MODULE VI VISUAL AIDS FOR NAVIGATION, VISUAL AIDSFOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES 8

Visual aids for navigation wind direction indicator – landing direction indicator – location and characteristics of signal area – markings, general requirements – various markings – lights, general requirements – aerodrome beacon, identification beacon – simple approach lighting system and various lighting systems – VASI & PAPI - visual aids for denoting obstacles; object to be marked and lighter – emergency and other services.

Total Hours: 45

TEXT BOOK:

"AIP (India) Vol. I & II", The English Book Store, 17-1, Connaught Circus, New Delhi.

REFERENCES:

"Aircraft Manual (India) Volume I", latest Edition – The English Book Store, 17-1, Connaught Circus, New Delhi.

"PANS – RAC – ICAO DOC 4444", Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.

OUTCOMES:

Students will be able to

- Acquire knowledge of the basic terminology of air traffic control and operation of aircraft in various airspaces.
- Apply the separation rules between two aircrafts in air laterally, vertically and horizontally.
- Acquire knowledge of the flow of traffic using various RADAR systems.
- Apply the emergency procedure and obstacle avoidance in and around the airports.
- Be familiar with various aerodrome terminology and classification of aerodromes.
- Gain knowledge of the aircraft's landing procedure using the various runway markings and lighting systems.

AEBX19 AIVIATION RULES AND REGULATION L T P C
3 0 0 3

OBJECTIVES:

To introduce the civil aviation regulations followed by Directorate General of Civil Aviation.

MODULE I C.A.R SERIES 'A' - PROCEDURE FOR CIVIL AIR WORTHINESS QUIRMENTS AND RESPONSIBILITY OPERATORS VIS-À-VIS AIR WORTHINESS DIRECTORATE 8

Responsibilities of operators / owners; procedure of CAR issue, amendments etc., objectives and targets of airworthiness directorate; airworthiness regulations and safety oversight of engineering activities of operators. C.A.R. SERIES 'B' - ISSUE APPROVAL OF COCKPIT CHECK LIST, MEL, CDL: Deficiency list (MEL & CDL); preparation and use of cockpit check list and emergency list.

MODULE II C.A.R. SERIES 'C' - DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING 7

Defect recording, reporting, investigation, rectification and analysis; flight report;reporting and rectification of defects observed on aircraft; analytical study of in-fight readings & recordings; maintenance control by reliability method.

C.A.R. SERIES 'D' - AND AIRCRAFT MAINTENANCE PROGRAMMES: reliability programme (engines); aircraft maintenance programme & their approval; on condition maintenance of reciprocating engines; TBO - revision programme; maintenance of fuel and oil uplift and consumption records - light aircraft engines; fixing routine maintenance Total Hours and component tbos - initial & revisions.

MODULE III C.A.R. SERIES 'E' - APPROVAL OF ORGANISATIONS: 10

Approval of organizations in categories A, B, C, D, E, F, & G; requirements of infrastructure at stations other than parent base. C.A.R. SERIES 'F' - AIR WORTHINESS AND CONTINUED AIR WORTHINESS: Procedure relating to registration of aircraft; procedure for issue / revalidation of type certificate of aircraft and its engines / propeller; issue / revalidation of certificate of airworthiness; requirements for renewal of certificate of airworthiness.

MODULE IV C.A.R. SERIES 'L' - AIRCRAFT MAINTENANCE ENGINEE LICENSING 8

Issue of AME licence, its classification and experience requirements, complete Series 'L'. C.A.R. SERIES 'M' MANDATORY MODIFICATIONS AND INSPECTIONS: mandatory modifications / inspections.

MODULE V C.A.R. SERIES 'T' - FLIGHT TESTING OF AIRCRAFT 6

Flight testing of (series) aircraft for issue of C of A; fight testing of aircraft for which C or A had been previously issued. C.A.R. SERIES 'X' - MISCELLANEOUS

REQUIREMENTS: Registration Markings of aircraft; weight and balance control of an aircraft; provision of first aid kits & physician's kit in an aircraft; use furnishing materials in an aircraft; concessions

MODULE VI AIRCRAFT DOCUMENTS PROCEDURE AND PERMITS 6

Aircraft log books; document to be carried on board on indian registered aircraft; procedure for issue of taxy permit; procedure for issue of type approval of aircraft components and equipment including instruments.

Total Hours: 45

REFERENCES:

" Aircraft Manual (India) ", Volume - Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.

" Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness) ", Published by DGCA, The English Book Store, 17-1, Connaught Circus,New Delhi.

" Aeronautical Information Circulars (relating to Airworthiness) ", from DGCA.

" Advisory Circulars ", form DGCA. as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Cod e of Conduct

OUTCOMES:

Students will be able to

- Gain knowledge of the need of certification and basic requirements of aircrafts airworthiness.
- Acquire knowledge of the rules prevailing in monitoring, defect identification and documentation of faults in aircrafts.
- Familiarize the organizations conducting the airworthiness programme
- Familiarize the various testing procedures followed in aircrafts before operation.
- Identify the types of licenses and their requirements.
- Familiarize the basic documents and medical kits to be carried onboard.

AEBX20 AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES **L T P C 3 0 0 3**

OBJECTIVE:

To introduce the basic concepts of aircraft general engineering and maintenance practices.

MODULE I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT **10**

Mooring, jacking, leveling and towing operations – Preparation – Equipment – precautions – Engine starting procedures – Piston engine, turboprops and turbojets – Engine fire extinguishing – Ground power unit.

MODULE II GROUND SERVICING OF VARIOUS SUB SYSTEMS **8**

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

MODULE III MAINTENANCE OF SAFETY **5**

Shop safety – Environmental cleanliness – Precautions

MODULE IV INSPECTION **10**

Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection – Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data sheets – ATA Specifications

MODULE V AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES **6**

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

MODULE VI OTHER SPECIFICATIONS AND SERVICES 6

American and British system of specifications – Threads, gears, bearings, etc – Drills, tapes and reamers–Identification of all types of fluid line fittings. Materials, metallic and non-metallic Plumbing connectors – Cables – Swaging procedures, tests, Advantages of swaging over splicing.

Total Hours: 45

TEXT BOOK:

Kroes Watkins Delp, “Aircraft Maintenance and Repair”, McGraw Hill, New York, 1993.

REFERENCES:

A&P Mechanics, “Aircraft Hand Book”, FAA Himalayan Book House, New Delhi, 1996

A&P Mechanics, “General Hand Book”, FAA Himalayan Bok House, New Delhi, 1996

OUTCOMES:

Students will be able to

.

- Keep abreast with procedure and standard maintenance practices.
- Gain knowledge on maintenance and flight safety aspects
- Gain knowledge on theoretical aspects of ground servicing of aircraft.
- Acquire knowledge on importance of aircraft documentation and various inspection schedules.
- Identify and gain knowledge on special aircraft tools and equipments
- Keep abreast with development of new generation aircraft and their system

GENERAL ELECTIVES

GEBX01 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.

To give exposure to various environmental policies & programs in India for disaster management.

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion.

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards.

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA 8

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

Total Hours: 45

REFERENCES:

Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.

Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.

Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.

Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.

Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.

Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.

Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.

Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.

be familiar with the National Policy on Disaster Management.

GEBX02 NANO TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

To introduce the basic concepts of Nanoscience relevant to the field of engineering.

To provide an exposure about the importance of various synthesis method.

To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force

microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

Total Hours: 45

TEXTBOOKS:

Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.

Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).

Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.

Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.

C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.

Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.

M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

Apply the knowledge of different types of nanomaterials for various engineering applications.

Acquire the knowledge of various methods of production of nanomaterials.

Familiarize with various characterization techniques.

GEBX03 CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

To understand the system modeling and to derive their transfer function.

To provide adequate knowledge of time response of systems and steady state error analysis.

To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION 8

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN 8

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN 7

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY 8

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN 8

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS 6

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC Tacho generator - DC Tacho generator - Typical applications of control system in industry.

Total Hours : 45

REFERENCES:

K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.

I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.

C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.

I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.

R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

Proper understanding of basics of Control Systems.

Ability and skill to carry-out time domain and frequency domain analysis.

Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.

Ability to design lag, lead and lag lead compensator networks.

GEBX04 GREEN DESIGN AND SUSTAINABILITY L T P C
3 0 0 3

OBJECTIVE:

To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development- Environment and development linkages - Globalisation and environment- Population, poverty and pollution- global, regional and local environment issues- Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN **8**

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

Total Hours: 45

TEXT BOOK:

Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCE:

Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

explain the relationship between sustainability and emergence of green building practices.

address the economic, environmental, and social concerns.

GEBX05 KNOWLEDGE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

The course

Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.

Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.

Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification - Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery - Content management tools - Knowledge sharing and dissemination tools - Group ware and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION **6**

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels - Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT **6**

KM return on investment and metrics - Benchmarking method - Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

Total Hours:45

TEXT BOOKS:

Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.

Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.

Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.

explains the core concepts, methods, techniques, and tools for computer support of knowledge management.

critically evaluate current trends in knowledge management and apply it for e-learning

GEBX06 APPROPRIATE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 9

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 9

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 9

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 9

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 9

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 9

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

Total Hours: 45

TEXT BOOKS:

Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.

Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.

John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOME:

At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GEBX07 SYSTEM ANALYSIS AND DESIGN L T P C
3 0 0 3

OBJECTIVES:

To understand the basic principles of systems engineering

To understand the systems engineering methodology

To provide a systems viewpoint

MODULE I INTERDICTION TO SYSTEMS ENGINEERING 8

Concept of Systems Engineering – Origin – Systems Approach – Advantages of systems approach – Examples.

The building blocks of modern systems – Systems and environment – Interfaces – Complexity of Modern Systems.

MODULE II SYSTEM DEVELOPMENT PROCESS AND MANAGEMENT 8

System life cycle – the systems engineering method – Role of Testing – Management of system development – Risk Management – Organisation.

MODULE III CONCEPT DEVELOPMENT 8

Need Analysis – Concept Exploration – Performance requirement and validation - Concept selection and validation – systems architecture – Decision making.

MODULE IV ESTABLISHING ENGINEERING SYSTEMS 8

Risk Analysis – Risk Mitigation –System performance Analysis – Simulation Techniques in System Analysis – Validation Methods..

MODULE V DECISION SUPPORT TOOLS IN SYSTEMS ENGINEERING 7

Analytical decision support – Statistical influences on system design – System performance analysis – System Reliability, Availability and Maintainability (RAM) – Analysis of Alternatives.

MODULE VI CASE STUDIES 6

Case studies in Software Systems Engineering – Systems for Product Design - Manufacturing Systems.

Total Hours: 45

REFERENCES:

Charles S. Wasson, “System Analysis, Design, and Development: Concepts, Principles, and Practices”, Wiley Series in Systems Engineering and Management, 2006.

Kossiakoff Alexander and William N. Sweet A, “Systems Engineering: Principles And Practice”, Wiley Student Edition, 2009.

OUTCOMES:

At the end of the course the student will have the

ability to have systems of view of problems and issues at hand.

ability to comprehend systems in their totality and specific.

ability to design, build and evaluate simple systems for industrial requirement.

ability to analyze systems and strengthen them for performance enhancement.

GEBX08 VALUE ANALYSIS AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To get acquainted with value analysis and engineering tool for productivity improvement.

To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

Total Hours: 45

TEXTBOOKS:

Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.

Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.

Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.

George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.

Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOME:

The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GEBX09 OPTIMIZATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

Introduce methods of optimization to engineering students, including linear programming, network flow algorithms, integer programming, interior point methods, quadratic programming, nonlinear programming, and heuristic methods.

The goal is to maintain a balance between theory, numerical computation, problem setup for solution by optimization techniques, and applications to engineering systems.

MODULE I INTRODUCTION 7

Overview of Optimization techniques for Civil Engineering Problems - Introduction to methods of optimization - Classification of Optimization problems - optimality and convexity - General optimization algorithm - necessary and sufficient conditions for optimality.

MODULE II LINEAR PROGRAMMING 8

Introduction to linear programming - a geometric perspective - Standard form in linear programming; basic solutions; fundamental theorem of linear programming - Simplex Algorithm for Solving Linear Programs - Duality; complementary slackness; economic interpretation of the dual;

MODULE III DYNAMIC PROGRAMMING 8

Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP); Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP.

MODULE IV APPLICATIONS 8

Regression modeling in engineering; industrial blending problems; dynamic optimal control of engineering systems; optimal estimation in environmental engineering - Water resources; production planning in industrial engineering; transportation problem - Heuristic optimization methods: genetic algorithms;

ecological engineering application; Minimum cost network flow algorithms; out-of-kilter method; primal-dual methods; Dynamic Programming Applications - Water allocation as a sequential process - Capacity expansion and Reservoir operation.

MODULE V INTEGER PROGRAMMING 8

Integer programming - applications in optimal irrigation scheduling in agricultural engineering - Interior point optimization methods - affine scaling method.

MODULE VI NON-LINEAR PROGRAMMING 6

Non-linear programming - Kuhn-Tucker conditions for constrained nonlinear programming problems; necessary and sufficient conditions; quadratic programming; applications.

Total Hours: 45

REFERENCES:

Taha, H.A., “Operations Research - An Introduction", 9th Edition, Pearson Prentice Hall, 2011.

Winston.W.L. “Operations Research”, 4th Edition, Thomson – Brooks/Cole, 2003.

Kreyszig .E., “Advanced Engineering Mathematics“,10th Edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.

OUTCOMES:

At the end of the course, the students will be able to understand

basic theoretical principles in optimization.

formulation of optimization models.

solution methods in optimization.

methods of sensitivity analysis and post processing of results.

applications to a wide range of engineering problems.

GEBX10 ENGINEERING SYSTEM MODELLING AND SIMULATION **L T P C 3 0 0 3**

OBJECTIVES:

To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.

To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION **6**

Systems – Modelling – types – systems components – Steps in model building-Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES **7**

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS **7**

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS **9**

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES **10**

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES **6**

Total Hours: 45

REFERENCES:

Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw Hill, Singapore, 2000.

Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.

Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.

Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.

David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

Model and simulate systems and environments through the use of computers.

Conduct experiments with discrete dynamic, stochastic system models on a computer.

GEBX11 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

To understand the various decision phases in a supply chain

To be aware of the Supply Chain and its drivers

To design Supply Chain Network

To build a aggregate plan in supply chain

To understand Sourcing Decisions in Supply Chain

To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 9

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 9

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 9

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV SOURCING AND TRANSPORTATION 9

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE V INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 9

Information technology in a supply chain – CRM, ISCM, SRM in supply chain - Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

Total Hours: 45

REFERENCES:

Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 4th Indian Reprint, 2010.

Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.

Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.

Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.

The student decision making capability specific to supply chain issues in an industry is improved.

The student can plan a well defined execution of supply chain strategy in companies.

The student will be able to design a optimal distribution network as per the demands of the industry.

The student can also determine the most favorable transportation plan for a company.

The student will also be able to bring in company from paper environment to paperless environment.

GEBX12 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

To understand the various principles, practices of TQM to achieve quality.

To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.

To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality

Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS **7**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

Total Hours: 45

TEXT BOOK:

Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.

Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.

Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.

Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.

Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

apply the various statistical tools and approaches for Quality control.

achieve continuous process improvement through TQM.

GEBX13 ENERGY STUDIES L T P C
3 0 0 3

OBJECTIVES:

To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.

To understand the basic need for energy conservation and waste heat recovery.

To learn the important aspects of energy audit and management.

To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipments. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENRGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

Total Hours: 45

TEXT BOOKS:

S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.

O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.

Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.

D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990

P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.

Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

Realize the global and national energy status and need to switch over to renewable energy technology.

Energy audit and suggest methodologies for energy savings.

Utilize the available resources in an optimal way.

Concern about the global environmental issues & promote carbon credits.

GEBX14 ROBOTICS L T P C
3 0 0 3

OBJECTIVE:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I INTRODUCTION 8

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL 8

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS 8

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES 7

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS 7

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity

of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

Total Hours: 45

REFERENCES:

Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.

Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.

Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.

Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.

Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.

Timothy Jordanides et al,"Expert Systems and Robotics", Springer –Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

Understand about the robots, its various components.

Design Robots for industrial applications.

Do programming for robots and apply them in real time applications.

GEBX15 CYBER SECURITY L T P C
3 0 0 3

OBJECTIVES:

To understand the basics of Cyber Security Standards and Laws.

To know the legal, ethical and professional issues in Cyber security.

To understand Cyber Frauds and Abuse and its Security Measures.

To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 8

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II TYPES OF THREATS AND SECURITY MEASURES 8

Security Programs – Non-malicious program Errors – Virus and other Malicious Code – Targeted Malicious Code – Control against program threats – Web Attacks – DOS – Online Security Resources.

MODULE III APPLICATION SECURITY 8

Introduction to Databases - Database Security Requirements – Reliability & Integrity – Multilevel Databases - E-Mail and Internet Security – SQL Injection – Cross Site Scripting – Local File Inclusion – Intrusion Detection Software"s.

MODULE IV PHYSICAL SECURITY AND FORENSICS 7

Firewalls – Benefits and Limitations – Firewall Types - Components – Server Room Design and Temperature Maintenance – Cyber Terrorism and Military Operation Attacks- Introduction to Forensics – Finding evidence on PC and Evidence on System Logs – Windows and Linux logs.

MODULE V CYBER STALKING & FRAUD 7

Introduction – Internet Frauds – Auction Frauds – Identity theft – Phishing – Pharming- Cyber Stalking – Laws about Internet Fraud – Protecting against Cyber Crime – Secure Browser settings – Industry Espionage.

MODULE VI CYBER SECURITY STANDARDS AND POLICIES 7

Introduction– ISO 27001– ISO 27002 - PCI DSS – Compliance - IT ACT – Copyright ACT, Patents. Definition of Policy – Types- User Policies- Administrative Policies – Access control – Developmental Policies.

Total Hours: 45

TEXT BOOK:

Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.

William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.

Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, attendees should be able to satisfy the critical need for ensuring Cyber Security in Organizations.

The students attending this course will be able to analyse the attacks and threats.

They can also provide solutions with Intrusion Detection systems and Softwares.

They will have knowledge about Cyber Frauds and Cyber Laws.

GEBX16 USABILITY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

The objective of this course is

To understand the emerging concept of usability, requirements gathering and analysis.

To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design, Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual

Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards

MODULE VI USER INTERFACES **7**

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

Total Hours : 45

TEXT BOOKS:

Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).

Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.

Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

build effective, flexible and robust user interfaces.

translate system requirements into appropriate human/computer interaction sequences.

choose mode, media and device for the application requirements.

GEBX17 INDUSTRIAL SAFETY L T P C
3 0 0 3

OBJECTIVE:

To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT 7

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING 7

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION 8

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY 8

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING 8

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

Total Hours: 45

REFERENCES:

Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.

Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.

Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.

Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.

Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

Acquire knowledge on various safety Hazards.

Carry out safety measures for different industrial environments.