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 AUTOMOBILE ENGINEERING

VISION

To become a department of excellence in providing quality education and training through academic and Research Programs in the field of Automobile Engineering.

MISSION

- To provide quality education and training in the field of automobile engineering through well structured curricular and co-curricular activities
- To provide training in analysis, design, simulation and implementation of automotive systems taking in to account environmental and ergonomic aspects
- To pursue academic and collaborative research, in automotive and other related fields and disseminate the outcomes through publications, seminars and workshops
- To develop 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. (Automobile Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge in science and mathematics required to understand the principles of automobile engineering
- To provide a detailed understanding of theory and ability to analyze and design automobile systems and sub-systems
- To expose the current trends in design and manufacture of automobiles
- Broaden the knowledge of automobile engineers by exposing them to interdisciplinary engineering fields
- To supplement the understanding of theory through laboratory experience and design projects
- To provide an understanding of managerial aspects, work culture, working in teams and professional ethics

PROGRAMME OUTCOMES

The students after graduation will

- Be capable of using the knowledge of basic sciences in solving problems related to automobile engineering
- Be able to design automobile systems, subsystems and components and work in manufacturing environment
- Possess the knowledge and skill in repair and maintenance of automobiles
- Be proficient in the application of computer tools for automobile design, operation, maintenance and management
- Be capable of applying modern and effective management skills in identification and investigation of problems, analysis of data, synthesis and implementation of solutions and operation of facilities related to automobile engineering

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

REGULATIONS - 2013 FOR
B.TECH. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme.

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

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

iv) **"University"** means B.S.Abdur Rahman University.

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

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

vii) **"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:

1. Aeronautical Engineering
2. Automobile Engineering
3. Civil Engineering
4. Computer Science and Engineering
5. Electrical and Electronics Engineering
6. Electronics and Communication Engineering
7. Electronics and Instrumentation Engineering
8. Information Technology
9. Manufacturing Engineering
10. Mechanical Engineering
11. 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,

i) Basic Sciences (BS)

ii) Humanities & Social Sciences (HS)

iii) Management Sciences (MS)

iv) Engineering Sciences Fundamentals (ESF)

v) Engineering Core Courses (EC)

vi) Professional Electives (PE)

vii) General Electives (GE)

viii) 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 (2nd to 8th 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:

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

ii) Course coordinators of all common courses.

iii) Faculty members of all individual courses.

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

v) 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:

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

ii) Faculty members of individual courses

iii) 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.

iv) All faculty advisors and the class advisor of the class

v) 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

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

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:

i) 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.

ii) 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. AUTOMOBILE 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	CHB1291	Chemistry of 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.	ESF	EEB1283	Basic Electrical Engineering	3	0	0	3
6.	HS	MEB1211	Material Science	3	0	0	3

7.	HS	CHB1292	Chemistry of Materials Laboratory	0	0	2	1
8.	ESF	ENB1282	Written Communication	0	0	2	1
9.	BS	MEB1212	Design Appreciation Lab	0	0	3	1
10.	ESF	EEB1284	Electrical Engineering lab	0	0	3	1
							24

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAB2181	Transforms and Applications	3	1	0	4
2.	BS	LSB2181	Biology for Engineers	3	0	0	3
3.	ESF	MEB2214	Fluid Mechanics	3	1	0	4
4.	ESF	MEB2102	Solid Mechanics	3	1	0	4
5.	ESF	MEB2103	Thermodynamics	3	1	0	4
6.	ESF	ECB2181	Electronics for Mechanical Systems	3	0	0	3
7.	HS	ENB2181	Oral Communication	0	0	2	1
8.	ESF	MEB2217	Fluid Mechanics and Machinery Lab	0	0	2	1
9.	ESF	MEB2105	Drafting and Modeling Lab	0	0	3	1
10.	ESF	ECB2182	Electronics Lab	0	0	3	1
							26

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	AUB2211	Automotive Chassis, Suspension, Steering and Wheels	3	0	0	3
3.	EC	AUB2212	Mechanics of Machinery	3	1	0	4
4.	EC	MEB2213	Basic Manufacturing Processes	3	0	0	3

5.	EC	AUB2213	Mechanical Metallurgy	3	0	0	3
6.	HS	SSB2281	Law for Engineers	3	0	0	3
7.	HS	ENB2282	Confidence Building & Behavioral Skill	0	0	2	1
8.	EC	MEB2215	Mechanics Lab	0	0	3	1
9.	EC	MEB2216	Manufacturing Processes lab	0	0	3	1
10.	EC	MEB2104	Material Testing Lab	0	0	2	1
							24

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
11.	EC	AUB3101	Two Wheelers and Three Wheelers	3	0	0	3
2.	EC	AUB3102	Design of Machine Elements	3	1	0	4
3.	EC	AUB3103	Petrol Engines	3	0	0	3
4.	EC	MEB3213	Metrology and Mechanical Measurements	3	0	0	3
5.	ESF	GEB3201	Environmental Science and Engineering	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	AUB3104	Computer Aided Drafting	0	0	3	1
9.	EC	AUB3105	Engine Components Lab	0	0	3	1
10.	EC	MEB3216	Metrology and Mechanical Measurements Lab	0	0	3	1
							23

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EC	AUB3211	Diesel Engines	3	0	0	3
2.	PE		Professional Elective II	3	0	0	3
3.	EC	AUB3212	Design of Automotive Components	3	1	0	4
4.	EC	AUB3213	Automotive Electrical & Electronics	3	1	0	4
5.	HS	MSB3181	Management of Business organization	3	0	0	3
6.	PE		Professional Elective III	3	0	0	3
7.	EC	AUB3214	Fuels and Lubricants Lab	0	0	3	1
8.	EC	AUB3215	Automotive Electrical & Electronics Lab	0	0	3	1
9.	EC	AUB3216	Four Wheeler Lab	0	0	3	1
10.	EC	AUB3217	Modeling and Analysis Lab	0	0	2	1
							24

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EC	AUB4101	Vehicle Dynamics	3	1	0	4
2.	EC	AUB4102	Automotive Transmissions	3	1	0	4
3.	EC	AUB4103	Engine Management System and Emission Control	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	AUB4107	Fabrication Project	0	0	3	1
8.	EC	AUB4104	Vehicle Maintenance Lab	0	0	3	1
9.	EC	AUB4105	Manufacturing Tech & CNC Lab	0	0	3	1
10	EC	AUB4106	Engine Testing and Emission Lab	0	0	3	1
							24

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	AUB4211	Project	0	0	18	9
							15

Total Credits: 185

PROFESSIONAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title
1.	PE	AUBX01	Finite Element Methods for Automotive Applications
2.	PE	AUBX02	Two Wheelers and Three Wheelers
3.	PE	AUBX03	Modeling and Simulation of Vehicle Systems
4.	PE	AUBX04	Evaluation of Vehicle Performance
5.	PE	AUBX05	Automotive Aerodynamics
6.	PE	AUBX06	Automotive Safety Systems
7.	PE	AUBX07	Combustion Thermodynamics and Heat Transfer
8.	PE	AUBX08	Jet Engines
9.	PE	AUBX09	Alternative Energy Vehicle
10.	PE	AUBX10	Noise Vibration and Pollution Control
12.	PE	AUBX11	Composites Materials for Automobiles
13.	PE	AUBX12	Vehicle Comfort System & Ergonomics
14.	PE	AUBX13	Traffic Engineering
15.	PE	AUBX14	Fuel Cell Technology
16.	PE	AUBX15	Simulation of IC Engines
17.	PE	AUBX16	Off Road Vehicles
18.	PE	AUBX17	Surface Engineering
19.	PE	AUBX18	Advanced Material Testing & Failure Analysis
20.	PE	AUBX19	Alternate Propulsion
21.	PE	AUBX20	Tractor and Agricultural Machines
22.	PE	AUBX21	Fleet Management
23.	PE	AUBX22	Applied Hydraulics and Pneumatics
24.	PE	AUBX23	Computer Aided Design and Manufacturing
25.	PE	AUBX24	Statistics and Quality Management
26.	PE	AUBX25	Vehicle Body Engineering
27.	PE	AUBX26	Professional Ethics in Engineering

28.	PE	MEBX03	Design of Jigs, Fixtures and Press Tools
29.	PE	MEBX07	Nano Materials & Fabrications
30.	PE	MEBX09	Micro Electro Mechanical Systems (MEMS)
31.	PE	MEBX12	Process Planning and Cost Estimation
32.	PE	MEBX19	Advanced Optimization Techniques
33.	PE	MEBX20	Advanced Production Processes for Automotive Components
34.	PE	MEBX25	Advanced IC Engines
35.	PE	MEBX28	Computational Flow and Heat Transfer

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:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., "Higher Engineering Mathematics" (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V, "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. 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

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

(b) 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.

(a) 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

(a) Writing slogans for Advertisements

(b) Writing descriptive paragraphs based on visuals

MODULE VI ENGLISH FOR ACADEMIC AND BUSINESS PURPOSES 9

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

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

Total Hours: 45

REFERENCES:

1. Mohan, Krishna, Meera Bannerjee, 'Developing Communication Skills', Macmillan India Ltd. Chennai (2001).
2. Sen , Leena 'Communication Skills' Prentice Hall, New Delhi (2004).
3. Rutherford , Andrea J. 'Basic Communication Skills For Technology' Pearson Education Asia (2002).
4. Grant Taylor, ' English Conversation Practice' Tata Mcgraw Hill , New Delhi (2001)
5. 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 : 2^{e} personne – Le pronom on=nous – Les verbes : Pouvoir, vouloir, devoir.

L'acte de parole

L'examen oral

Total Hours: 45

TEXT BOOK:

1. 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:

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

REFERENCES:

1. 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:

1. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.

REFERENCES:

1. Uma Mukherji, "Engineering Physics", Narosa Publishing House, New Delhi, 2007.
2. Charles Kittel, "Introduction to solid state physics", 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd, 2008.
3. Avadhanulu M.N., "Engineering Physics", 1st Edition, S.Chand & Company Ltd., New Delhi, 2007.
4. Schiff, "Quantum Mechanics", 3rd Edition, Tata McGraw-Hill Education, 2010.
5. Rajendran V. and Marikani A., "Applied Physics for Engineers", 3rd Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2003.

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

7. 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:

1. Jain P.C and Renuka Jain, 'Physical Chemistry for Engineers', Dhanpat Rai and Sons, New Delhi. (2001).
2. Paul T. Anastas, John C. Warner, 'Green Chemistry: Theory and Practice', Oxford University Press, (1998).

REFERENCES:

1. Bahl B.S., Tuli and Arun Bahl, 'Essentials of Physical Chemistry', S. Chand and Company Ltd., New Delhi, (2004).
2. Kuriacose J.C. and Rajaram J, 'Chemistry in Engineering and Technology', Volume1, Tata McGraw- Hill publishing company, New Delhi, (1996).
3. 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:

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

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2006)
2. 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:

1. Samir Das Gupta and Paulomi Saha, An Introduction to Sociology, Pearson, Delhi, 2012.
2. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
3. Vidya Bhushan and D.R. Sachdeva, Fundamental of Sociology, Pearson, Delhi, 2012.
4. Deshpande, Satish, Contemporary India : A Sociological view, Viking (2002)
5. Thopar, Romila, Early India, Penguin (2003).
6. 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:

1. Torsional Pendulum- Determination of rigidity modulus of a given wire.
2. Determination of coefficient of viscosity of a liquid by Poiseuille's method .
3. Determination of Young's modulus of a beam using non – uniform bending method.
4. Determination of a thickness of a given wire – Air wedge.
5. Spectrometer- determination of wavelength of given source by using grating.
6. Determination of velocity of ultra sonic waves – Ultrasonic Interferometer.
7. Determination of numerical aperture and acceptance angle of an optical fiber.
8. Determination of particle size using Laser.
9. Growth of crystal by slow evaporation technique.
10. Determination of angle of divergence of Laser beam.
11. 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:

1. Estimation of hardness in domestic water.
2. Estimation of total dissolved solids (TDS) in domestic water
3. Construction and determination of emf of a cell.
4. Determination of single electrode potential.
5. Estimation of strong acid in the industrial effluents
6. Estimation of Fe^{2+} present in unknown sample – by Potentiometry
7. Verification of Beer-Lambert's law and estimation of Cu^{2+} present in unknown sample.
8. Estimation of Na and K present in the agricultural field – by flame photometry.
9. 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

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mould preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC,MCCB,ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp.

ELECTRONIC ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Solderingand tracing of electronic circuits and checking its continuity
3. 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**

1. Computer organization –Hardware in a typical computer Identification – Booting - error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types Type conversions
5. Input/Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. 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
8. Arrays – Operation with arrays
9. Sorting and searching

Total Hours: 60

TEXTBOOKS:

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

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., "Higher Engineering Mathematics" (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. 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.

CHB1291 CHEMISTRY OF MATERIALS L T P C

3 0 0 3

OBJECTIVES

To make students conversant with

- The three types of fuels available and the different processes involved in it.
- The calculations involved in calorific values and minimum air requirement for complete combustion.
- The classification, functions, mechanism and properties of lubricants.
- The classification and description of different types of batteries.
- The five types of corrosion and six methods to control it.
- The polymeric materials used in engineering applications.

MODULE I FUELS 8

Classification of fuels – Solid, Liquid and Gaseous fuel (comparison) – petroleum (refining, fractions, composition and uses) – cracking: thermal and catalytic (fixed bed and moving bed) – synthetic petrol: Fischer-Tropsch – knocking: octane number, improvement of octane number (antiknocking) – diesel engine fuel: cetane number, improvement of cetane number, biodiesel (trans-esterification) – producer gas – water gas – CNG – LPG – biogas.

MODULE II COMBUSTION 7

Combustion – calculation of minimum requirement of air (problems) – Gross and net calorific values (definition and relationship) – theoretical calculation of calorific values (Dulong's formula, problems) – Bomb Calorimeter – Boy's Gas Calorimeter (problems) – flue gas analysis by Orsat apparatus.

MODULE III LUBRICANTS 6

Lubricants and lubrication: definition, functions and classification with examples – properties: viscosity index, flash and fire point, cloud and pour point, oiliness, carbon residue, aniline point – greases: calcium, sodium and lithium based – solid lubricants – graphite and molybdenum disulphide.

MODULE IV ENERGY STORING DEVICES AND SENSORS 7

Introduction – types of batteries (primary, secondary and flow cell) primary batteries: dry cells, alkaline batteries – secondary batteries; lead acid storage cell, nickel - cadmium cell – flow cell: hydrogen-oxygen fuel cell – lithium battery – solar cell – dye sensitized solar cell – sensors: types, working principle and applications.

MODULE V CORROSION AND ITS CONTROL 9

Introduction – Galvanic series – types of corrosion: galvanic corrosion, differential aeration corrosion, pitting corrosion and stress corrosion – corrosion control: cathodic protection (sacrificial anode protection method) – selection of materials and proper designing – corrosion inhibitors – Electroplating – Electrolessplating – Hot dipping (galvanizing and tinning) – Chemical conversion coatings (Chromate, phosphate, oxide coating, Anodizing).

MODULE VI POLYMERIC MATERIALS 7

Engineering plastics: Introduction and advantages – preparation, properties and applications of polycarbonates, TEFLON, polyurethane, nylon-6,6, Kevlar – Thermosetting resins: bakelite – polyester- vulcanization of rubber - rubber blended plastics: ABS plastics – laminated plastics: process – polymer blends and polymer alloys, FRP: glass, carbon, aramid- properties and uses

TEXT BOOKS :

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2002.
2. Puri B.R., Sharma C.R. and Madan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., 2000.

REFERENCES :

1. Wang M.N., Polymers for electronic and photonic applications, Wiley New York, 1994.
2. Bahl B.S., Tuli G.D. and Arun Bhal, Essentials of Physical Chemistry, S. Chand and Co. Ltd., New Delhi, 2003.
3. Ray G.D., Nonconventional Energy Sources.

OUTCOMES:

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

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize and describe the different lubricants into three types and also employ in daily life.
- illustrate eight types of batteries with the aid of a diagram.
- explain and recognize five types of corrosion, when the description is given. They will also be able to describe the corrosion inhibition methods and apply a few in their daily life.
- identify eleven types of polymeric materials and relate it to their application in daily use.

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:

1. Vanitha Agarwal, 'Macroeconomics: Theory and Practice', Pearson, (2010).
2. Dwivedi D.N, 'Macroeconomics: Theory and Policies', 3rd edn; McGraw Hill, (2010).
3. Samuelson,Paul A., 'Macroeconomics', 19th edn., TMH, (2009).
4. 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:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. 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

EEB1283 BASIC ELECTRICAL ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES:

To impart knowledge on

- Basic concepts of electrical circuits and their solutions
- Principle of operation, characteristics and applications of various D.C. and A.C. machines
- Usage of the machines as drives
- Concepts of control systems and its components

MODULE I DC AND AC CIRCUITS **10**

Introduction to DC circuits: Ohm's law - Kirchoff's law - series and parallel connections - branch currents and voltages across elements - star-delta and delta-star transformation. Introduction to AC circuits: phasor representation – real, reactive and apparent powers - 3 phase circuits - star and delta connections – simple problems.

MODULE II DC MACHINES **9**

DC generators and DC motors: Construction – types – principle of operation - characteristics – starting and speed control – load test and performance characteristics – efficiency – applications – simple problems.

MODULE III TRANSFORMERS **6**

Transformers: Construction – types – principle of operation - Ideal transformers – loading of transformers – equivalent circuit - voltage regulation –efficiency - simple problems.

MODULE IV INDUCTION MOTORS **6**

Three phase Induction motor: Construction – types - principle of operation – starting and running torques – torque Vs slip characteristic – starting and speed control - simple problems.

MODULE V INTRODUCTION TO CONTROL SYSTEMS **8**

Differential equations and transfer function of mechanical and electrical

systems – time response of first and second order systems - errors – components: servo motors and stepper motors.

MODULE VI SOLID STATE DRIVES 6

Introduction to thyristors – types – principle of operation – speed control of DC motors and Induction motors using SCRs - PWM drives – variable voltage variable frequency drives.

Total Hours : 45

REFERENCES:

1. William H.Hayt Jr, Jack E. Kemmerley, and Steven M. Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2002.
2. Sudhakar A and Shyam Mohan S P, “Circuit and Network Analysis and Synthesis”, McGraw Hill Publishing Co. Ltd., 2007.
3. Edward Hughes, “Electrical and Electronics Technology”, Pearson India, 9th Edition, 2007.
4. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, McGraw Hill Publishing Co. Ltd., 2nd Edition, 2002.
5. Cotton H, Electrical Technology, Pitman, 2004.
6. B L Theraja and A K Theraja, “A textbook of Electrical Technology”, S.Chand, 2005.

OUTCOMES:

On completion of this course, the student will be familiar with

- The basics of electrical circuits and their solution methods
- Usage of various DC and AC machines as drives
- Concepts of control systems.

MEB1211 MATERIAL SCIENCE L T P C
3 0 0 3

OBJECTIVES:

- To integrate the materials science, manufacturing and mechanics knowledge that students have from previous courses and apply it to engineering design
- To impart knowledge on the structure, properties, testing and applications of materials so as to identify and select suitable materials for various engineering applications.

MODULE I CRYSTALLOGRAPHY AND SOLID SOLUTIONS 9

Review of crystal structure, space lattice, crystal planes and crystal directions, Numerical related to crystallography. Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects & effects of imperfections on metal properties.

Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram

MODULE II HEAT TREATMENT 9

Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite. Heat treatment of steels, cast iron, stainless steel , aluminum , copper, magnesium and titanium .

MODULE III TESTING OF OF METALS 9

Testing of materials under tension, compression and shear loads – Hardness tests (Brinnell, Vickers and Rockwell) Impact test - Izod and Charpy. Tests for creep and fatigue.

MODULE IV NEWER MATERIALS **7**

Ferrous and Non ferrous metals, Engineering Ceramics – Properties and applications, Composites, Shape Memory Alloys, Smart materials, Nanocrystalline Materials, Super alloys, Intermetallics, Biomaterials.

MODULE V MATERIAL SELECTION **6**

Factors influencing materials selection: mechanical properties, physical properties, manufacturing techniques, cost, Case studies.

MODULE VI FAILURE ANALYSIS **5**

Wear and Corrosion Failures- Factors Influencing Failures, Analysis of Failures. Failure Analysis Techniques, simple case studies.

Total Hours : 45

REFERENCES:

1. Lawrence.H.Van Vlack, “Elements of Material Science and Engineering”,Addison Wesley Pub,1980.
2. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised Indian edition, 2007.
3. Michael F. Ash, “Materials Selection in Mechanical Design”, 4th Edition Butterworth-Heinemann, 2011.
4. Michael F. Ashby and David R. H. Jones, “Engineering Materials- An Introduction to their Properties and Applications”, 2nd Edition, Butterworth-Heinemann, 2002.
5. Kenneth G. Budinski, Michael K. Budinski, “Engineering Materials, Properties and Selection”, 8th Edition, Pearson Education, 2005
6. Sydney Avner, “Introduction to Physical Metallurgy”, McGraw Hill Ltd, 1974.

OUTCOMES:

- Be able to describe the structure and classify engineering materials.
- Understand properties and behavior of engineering materials.
- Know about the modes of failure (ductile/brittle fracture, fatigue, creep and corrosion) of engineering materials.
- Know how to use information sources to select materials for engineering uses.

CHB 1292	CHEMISTRY OF MATERIALS LABORATORY (FOR AUTOMOBILE ENGINEERING)	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To make students conversant with the practical experiments relevant to the theory.

EXPERIMENTS:

1. Determination of dissolved oxygen in the given water sample
2. Study of corrosion of a metal in different corrosive mediums
3. Electrodeposition of a metal over an article
4. Determination of flash and fire point of a lubricant using Pensky-Marten's apparatus
5. Determination of cloud and pour point of a lubricant.
6. Preparation of biodiesel using trans-esterification method.
7. Determination of calorific value of a fuel using Bomb calorimeter
8. Preparation of a polymer (Nylon6,6/Bakelite)
9. Determination of viscosity average molecular weight of polymer

OUTCOMES:

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

- calculate the dissolved oxygen present in water sample, molecular weight of the polymer and calorific value of a fuel.
- determine flash, fire, cloud and pour point for lubricants
- prepare biodiesel and a polymer.

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:

1. Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
2. Gerson, Sharon & Steven M. Gerson, 'Technical Writing: Process and Product' Pearson Education, New Delhi. 2004.
3. M Ashraf Rizvi 'Effective Technical Communication'. Tata McGraw-Hill Education, 2005.
4. Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing". Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002.
5. 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.

MEB1212	DESIGN APPRECIATION LABORATORY (Common for Mechanical, Aeronautical and Automobile Engineering)	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To appreciate the use of various mechanisms involved in engineering products
- To gain the knowledge through experience of handling of engineering products
- To understand reinforcement of specific knowledge from other courses through practice and reflection in an action-oriented setting
- To know the importance of team working skills

STUDY EXERCISE:

1. Study of Standard Components

PRACTICAL EXERCISE:

Do the teardown process on following Engineering products, and also can be aware of

- Identification of the components
- Functions of the components
- Mechanisms involved
- Material and manufacturing process involved

1. 2 Stroke petrol engine
2. 4 Stroke petrol engine
3. Reciprocating Compressor / blower/ Rotary Compressor
4. Axial and radial piston pump
5. Gear pump and vane pump
6. Reciprocating pump (single and multi acting)
7. Centrifugal pump (Mono block, Coupled type) and submersible pump
8. Fixed reduction gear box
9. Valves
10. Work holding devices

11. Mechanical components in electronic devices (CDD, HDD and printer)
12. Fuel feed pump and carburetor
13. Transmission system for diesel engine
14. Front axle and Steering
15. Rear axle and Differential

OUTCOMES:

On completion of the course, the students

- Would have understood the importance of design features in various engineering components.
- Will have awareness about single product meets multiple functions.
- Would have gained confidence in abilities to handle various engineering products and kindle own creativity and ideation.
- Enhanced team working skills.

EEB1284	ELECTRICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand,simulate and verify Thevenin's and Norton's theorem.
- To understand and verify the characteristics of various Electrical Machines
- To understand the three phase Power Measurement in AC circuits.

LIST OF EXPERIMENTS:

1. Verification of Thevenin's theorem and Norton's theorem using MATLAB
2. Open circuit characteristics and Load Characteristics of Self Excited DC Generator
3. Load Test on DC Shunt and DC Series Motor
4. Load Test on Single Phase Transformer
5. Load Test on Three Phase Induction Motor
6. Measurement of 3 phase power using 2 wattmeter method

OUTCOMES:

At the end of the course, the student should be able to:

- Construct and simulate any given simple electric circuits and verify theorems using MATLAB
- Study and understand the performance of Electrical Machines
- Measure the three phase power.

SEMESTER III

		L	T	P	C
MAB 2181	**TRANSFORMS AND APPLICATIONS (Common to all branches)**	**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:

1. Veerarajan.T., “Engineering Mathematics“, 5th Edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publishers, New Delhi, 2012.

REFERENCES:

1) Kreyszig .E., “Advanced Engineering Mathematics“, 10th Edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2) Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage Learning, 2011.
3) Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th Edition, Jones and Bartlett publishers, Sudbury, 2011.
4) Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.
5) Ramana B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

OUTCOMES:

- Find general solutions of first order separable ordinary differential equations.
- Find the Laplace transform of a function from the definition of a Laplace transform.
- Find the Laplace transform of the exponential, cosine and sine functions.

- Carry out arithmetic operations for complex numbers.
- Convert complex numbers between Cartesian and exponential form.
- Apply the chain rule to partial differentiation.
- Apply gradient vectors to find directional derivatives.

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 – cell structure and functions – Prokaryotic and Eukaryotic cells, cell wall, plasma membrane, endoplasmic reticulum, nucleus, chromosomes- cell division – mitosis, meiosis.

MODULE II BIOCHEMISTRY 8

Biomolecules – introduction – pH and biological buffers – carbohydrates- mono, di, oligo and polysaccharides, lipids- phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglanin – proteins – types – glycoproteins, lipoproteins – structures - primary, secondary, tertiary and quarternary – Nucleic acids – RNA – Types – tRNA, mRNA, giRNA, miRNA, DNA – rDNA, gDNA, cDNA.

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 and cloning.

MODULE IV MICROBIOLOGY 8

Microbiology – basis of microbial existence – microbial diversity – classification and nomenclature of micro-organisms- impact of microorganisms in 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, 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:

1. Johnson, Arthur T., “Biology for Engineers”, CRC Press, FL, 2011.
2. Campbell and Recee, “Biology”, Pearson, Benjamin Cummins Pub. 8th edition, 2008.
3. Scott Freeman, “Biological Sciences”, Prentice Hall, 2002.

OUTCOMES:

After finishing this course students will be able to

- understand basics of biological processes, composition of cell contents
- understand applications of microbes in industrial manufacturing of proteins, antibodies and antibiotics.
- understand cloning and genetic engineering
- identify the genes in different genome (plants, microbes, animals, human) and compare the genes by bioinformatics approaches

MEB2214	FLUID MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the concepts of fluid statics viscosity and buoyancy.
- To make the students to understand the basic laws namely, mass momentum and energy.
- To study the various losses in flow through pipes and estimate these losses.
- To introduce the construction, working and analysis of fluid machinery.

MODULE I BASIC CONCEPTS AND PROPERTIES 10

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

MODULE II FLUID KINEMATICS AND FLUID DYNAMICS 11

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

MODULE III INCOMPRESSIBLE FLUID FLOW 10

Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's)

MODULE IV FLOW THROUGH PIPES 9

Hydraulic and energy gradient - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel- power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

MODULE V HYDRAULIC TURBINES **10**

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

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

MODULE VI HYDRAULIC PUMPS **10**

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

Total Hours: 60

TEXT BOOKS:

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd, New Delhi, 1995
2. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995.
3. Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers,1992

REFERENCES:

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
2. White, F.M., "Fluid Mechanics", Tata McGraw-Hili, 5th Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
4. Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hili, 2nd Edition, 2004.

OUTCOMES:

- Be able to understand the behavior of fluids.
- Understand the various laws and application of these laws into fluid machineries.
- Understand the various losses in flow through pipes and the methods to determine these losses.

MEB2102 SOLID MECHANICS L T P C
3 1 0 4

OBJECTIVES:

- To gain knowledge of simple stresses, strains and deformation in components.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

MODULE I STRESS STRAIN AND DEFORMATION OF SOLIDS 10

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

MODULE II BEAMS - LOADS AND STRESSES 12

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

MODULE III TORSION 8

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts.

MODULE IV BEAM DEFLECTION 10

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method.

MODULE V APPLICATION OF TORSION AND BEAM DEFLECTION 10

Application to close-coiled helical springs – Maximum shear stress in spring

section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads.

Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns.

MODULE VI ANALYSIS OF STRESSES IN TWO DIMENSIONS 10

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

Total Hours: 60

TEXT BOOK:

1. Beer F. P. and Johnston R, Mechanics of Materials, McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES:

1. Popov E.P, Engineering Mechanics of Solids, Prentice-Hall of India, New Delhi, 1997.
2. Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
3. Timoshenko S.P, Elements of Strength of Materials, Tata McGraw-Hill, New Delhi 1997.
4. Ryder G.H, Strength of Materials, Macmillan India Ltd., Third Edition, 2002.
5. Ray Hulse, Keith Sherwin & Jack Cain,"Solid Mechanics", Palgrave ANE Books, 2004.
6. Singh D.K "Mechanics of Solids" Pearson Education 2002.
7. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 1981.

OUTCOMES:

- Should have gain knowledge of simple stresses, strains and deformation in components.
- Should have understood the effect of stresses and deformations on component dimensions and shape.
- They should have gained basic knowledge for use in the design courses

MEB2103	THERMODYNAMICS (Use of standard Steam tables, Mollier diagram, Psychrometric chart is permitted)	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To gain knowledge on the concept of systems and energy transfer
- To understand analyze and apply the basic laws of thermodynamics
- To understand the principle of steam power cycle and its improvement
- To understand thermodynamic relations and their significance
- To gain knowledge on the properties of moist air and psychrometric processes

MODULE I BASIC CONCEPT AND FIRST LAW 10

Basic concepts - concept of continuum, macroscopic approach, types of thermodynamic systems. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

MODULE II SECOND LAW, ENTROPY AND AVAILABILITY 10

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem, absolute entropy, availability, Concept of Exergy analysis.

MODULE III PROPERTIES OF PURE SUBSTANCE AND VAPOUR PROCESSES 10

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes.

MODULE IV STEAM POWER CYCLES **10**

Standard Rankine cycle, Modified Rankine cycle, cycle improvements - reheat cycle and regenerative cycle. Simple problems.

MODULE V GAS MIXTURES AND THERMODYNAMIC RELATIONS **10**

Gas mixtures – properties of ideal and real gases, equation of state, Vander Waal's equation of state, compressibility factor, compressibility chart – Dalton's law of partial pressure, Amagut law, T-ds equations, Maxwell's relations, Clausius Clapeyron equations, Joule – Thomson coefficient.

MODULE VI PSYCHROMETRY **10**

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, simple problems.

Total Hours: 60

TEXT BOOKS :

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 1998.
2. Cengel, "Thermodynamics An Engineering Approach", 3rd Edition – 2003, Tata McGraw Hill, New Delhi.

REFERENCES :

1. Holman.J.P., "Thermodynamics", 3rd Edition McGraw-Hill, 1995.
2. Natarajan. E., "Engineering Thermodynamics" Anuragam Publications, Chennai, 2012.
3. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. Sri Vastava R.C, Saha S. K, Jan A. K, "Thermodynamics" Prentice Hall of India, New Delhi, 2004.

OUTCOMES:

The student should be able to

- conceptualize and apply the laws of thermodynamics to any real life situation
- design and analyze steam power cycles
- synthesize and utilize thermodynamic relations for practical problems solving
- design and analyze air- conditioning problems

ECB2181 ELECTRONICS FOR MECHANICAL SYSTEMS **L T P C**
3 0 0 3

OBJECTIVES:

- To study the characteristics of semiconductor devices such as diodes, transistors and their applications
- To study fundamentals of digital logic circuits
- To study 8085 microprocessors and its interfacing with other peripheral devices.

MODULE I SEMICONDUCTORS AND RECTIFIERS **6**

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction and its application - Zener diode.

MODULE II SEMICONDUCTORS AND RECTIFIERS **8**

Bipolar junction transistor- CB, CE, CC configuration and characteristics- Field effect transistor:Configuration and characteristic-SCR, DIAC, TRIAC, UJT-Characteristics and simple applications.

MODULE III DIGITAL ELECTRONICS **9**

Number systems- Binary Arithmetic Operations-Boolean Algebra-Logic gates-Karnaugh map:SOP,POS.

MODULE IV COMBINATIONAL and SEQUENTIAL CIRCUITs **8**

Combinational Circuits: Half and full adders- Magnitude Comparator-Multiplexer/ Demultiplexer- encoder / decoder

Sequential circuits: Flip Flops: SR, JK, D and T FF- Truth tables and circuits-Shift Registers-Ripple Counters.

MODULE V 8085 MICROPROCESSOR **7**

Architecture of 8085-Pin configuration- Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

MODULE VI INTERFACING AND APPLICATIONS OF MICROPROCESSOR 7

Architecture of 8085-Pin configuration- Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

Total Hours: 45

TEXT BOOKS:

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers,1995.
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCES:

1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill,1996.
2. Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd, 1994
3. Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.
4. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" First Edition, Tata McGraw-Hill, 1999.

OUTCOMES:

- Working principles and characteristics of various semiconductor devices
- Different digital logic circuits : Combinational and sequential circuits
- Architecture of 8085, its features and programming for specific application

ENB2181	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**

(i) Oral Communication – Implications in real life and work place situations

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

(iii) Prepared presentations and extempore presentations

(iv) 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

(v) 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:

1. Hancock,Mark. "English Pronunciation in Use". Cambridge University Press, UK. 2005.
2. Anderson, Kenneth & et.al. "Study Speaking : A Course in Spoken English for Academic Purposes" (Second Edition). Cambridge University Press, UK. 2004.
3. Hurlock, B. Elizabeth. "Personality Development". Tata McGraw Hill, New York. 2004.

OUTCOMES:

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

MEB2217 FLUID MECHANICS AND MACHINERY LAB **L T P C**

0 0 2 1

OBJECTIVES:

- To learn about the various measurements of fluid parameters
- To verify the laws of fluid mechanics
- To study the performance of various pumps and turbines.

LIST OF EXPERIMENTS:

1. Comparison of Coefficient of Discharge of given Orifice meter and venturimeter.
2. Calibration of Rota meter.
3. Determination of friction factor for the given set of pipes
4. Performance study of centrifugal pumps / Submersible pumps.
5. Determination of maximum efficiency for the given reciprocating pump.
6. Characteristic curves for Gear pump / Vane pump.
7. Determination of maximum power at constant speed / constant load for an impulse turbine.
8. Performance characteristic of Reaction turbine.
9. Impact of jet on flat and curved vanes.
10. Verification of Bernoulli's theorem.
11. Performance test on a jet pump.
12. Flow visualization :- Laminar and Turbulent flows

Total Hours : 30

OUTCOMES:

- Students will learn the parameters important for measuring the fluid flows.
- They will be able to run and calculate the performance of the pumps and turbines

MEB2105	DRAFTING AND MODELING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- Able to Explain how computer technology is revolutionizing drafting, design, and engineering.
- Able to Describe the basic features and operation of a computer-aided drafting program.
- Able to Explain the various commands used to create objects in CAD.
- Able to Describe the tools used to modify CAD drawings.
- Able to Identify the various display functions used in CAD programs.
- Able to Describe the typical components in a CAD program Help system.
- Able to Explain the importance of CAD ?le management and identify common storage techniques.
- Able to List different types of CAD software and their applications.

DRAWING STANDARDS

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.

INTRODUCTION TO DRAFTING SOFTWARE

Drawing, Editing, Dimensioning, Plotting Commands, Layering concepts, Limits, Fits and Tolerances.

PREPARATION OF 2-D DRAWINGS

Orthographic views of standard machine components: Brackets, V Blocks, Stop Block, Screw threads and Threaded fasteners.

ASSEMBLY DRAWING

Shaft Couplings: rigid, flexible

Joints - Cotter joints, knuckle joints, Hook’s joints.

Bearings - Journal - Footstep thrust or Collar bearing, Plummer block.

Engine parts - Stuffing box, Connecting rod.

Valves safety valve, relief valve, non-return valve.

Machine tool components - Drill jig, Tool post, machine vice, screw jack.

Total Hours:45

REFERENCES:

1. R.W.Lueptow, M.T.Snyder, J.Steger, Graphics Concepts with Pro/Engineer, Prentice Hall, 2001
2. S.A. Sorby, Solid Modeling with I-DEAS, Prentice Hall, 2000.
3. J.A. Leach, AutoCAD 14 Instructor, WCB McGraw Hill, 1998.
4. N.N., Mechanical Desktop R3 Tutorial, Autodesk Inc., 1998.
5. N.N., Mechanical Desktop Getting Started, Autodesk Inc., 1998.
6. G.R.Bertoline, et.al., Technical Graphics Communication, WCB McGraw-Hill, 1997
7. A.Tizzard, An Introduction to Computer-aided Engineering, McGraw-Hill, 1944.
8. F.E. Giesecke, et.al., Engineering Graphics, Prentice Hall, 2000.
9. O. Ostrowsky, Engineerign Drawing with CAD Applications, ELBS Pub., 1993

OUTCOMES:

- Demonstrate proper visualization in various views of three-dimensional object by producing a multi-view drawing.
- Identify, select and apply the sectional view that is appropriate to show interior features for dimensioning.
- Calculate and apply tolerancing and the relationship between mating parts on assembly drawings.
- Through calculation, select various appropriate purchased parts for diverse applications.

ECB2182	ELECTRONICS AND MICROPROCESSOR LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- At the end of the course the students are expected to know how to specify, design, and prototype a microprocessor-based embedded system.
- To achieve this objective the students have to develop a semester-long project consisting of specifying, designing, and prototyping an embedded system solution to a real life problem.

Sl.No	NAME OF THE EXPERIMENT
1.	VI characteristics of PN Junction Diode
2.	VI characteristics of Zener Diode
3.	Characteristic of CE Transistor
4.	Characteristics of JFET
5.	Characteristics of Uni Junction Transistor
6.	Study of Logic Gates (Basic Gates)
7.	Half Adder and Full Adder
8.	Shift Register
9.	Ripple counter
10.	8 bit addition, subtraction
11.	Multiplication and division
12.	Maximum and Minimum of block of data
13.	Sorting and block transfer
14.	Stepper Motor Interfacing
15.	Traffic light controller

Total Hours: 30

OUTCOMES:

- Students should be able to solve basic binary math operations using the microprocessor.
- Students should be able to demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor.
- Students should be able to program using the capabilities of the stack, the program counter, and the status register and show how these are used to execute a machine code program.
- Students should be able to apply knowledge of the microprocessor's internal registers and operations by use of a PC based microprocessor simulator.
- Students should be able to write assemble assembly language programs, assemble into machine a cross assembler utility and download and run their program on the training boards.
- Students should be able to design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.
- Students should be able to write assembly language programs and download the machine code that will provide solutions real-world control problems such as fluid level control, temperature control, and batch processes

SEMESTER IV

MAB2283 APPLIED NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVE:

- 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, $\nabla, \mu, \Delta, \Delta$).

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**

Milne'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:

1. 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:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna Publishers, 2007
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” Pearson Education, New Delhi 2002.
3. P. Dechaumphai, N. Wansophark, ”Numerical Methods in Engineering”, Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- Solve system of equations and eigen value problem of a matrix numerically.
- Use interpolation and find intermediate values for given data.
- Find numerical solution of differential equations in engineering problems.

AUB2211	AUTOMOTIVE CHASSIS, SUSPENSION, STEERING AND WHEELS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Study of the Constructional details and mechanism of drive line, Structures, Steering, Braking and Suspension Systems of Automobiles
- To solve the Problem related to Steering Mechanism, Propeller Shaft, Braking and Suspension Systems

MODULE I INTRODUCTION AND FRAME, STEERING SYSTEM 6

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames

MODULE II FRONT AXLE AND STEERING SYSTEMS 7

Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

MODULE III PROPELLER SHAFT AND FINAL DRIVE 8

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

MODULE IV AXLES AND TYRES 8

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

MODULE V SUSPENSION SYSTEM **8**

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details, Design of Leaf and Coil Springs.

MODULE VI BRAKING SYSTEM **8**

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders, Types and Construction, Anti–Lock Braking System, Constructional Details. Traction control, Hill assist, Engine brakes (alias Jake brake)

Total Hours: 45

TEXT BOOKS:

1. Kripal Singh, Automobile Engineering, Standard Publisher, New Delhi, 2006
2. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited, 2007
3. N.K. Giri, Automotive Mechanics, Kanna Publishers, 2007

REFERENCES:

1. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
2. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
3. Heinz Hazler, Modern Vehicle Technology, Butterworth, London, 2005.

OUTCOME:

- Be able to understand and analyze various subsystems like drive line, Structures, Steering, Braking and Suspension Systems of Automobiles

AUB2212 MECHANICS OF MACHINERY L T P C
3 1 0 4

OBJECTIVES:

- To understand the layout of linkages in the assembly of mechanisms and machines.
- To study the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism
- To analyze the kinematics of machineries such as cam, toothed gearing and gear trains.
- To understand the kinematic aspects of friction involved in machineries such as belts, clutches and brakes
- To learn about the fundamentals of Vibration and Dynamics

MODULE I MECHANISMS 11

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

MODULE II FRICTION 10

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

MODULE III GEARS 10

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicylic gear trains – Determination of speed and torque

MODULE IV CAMS 9

Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

MODULE V BALANCING **10**

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

MODULE VI VIBRATION **10**

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

Total Hours: 60

TEXT BOOKS :

1. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co., New Delhi, 2004.
2. Ballaney.P.L, “Theory of Machines”, Khanna Publishers, New Delhi, 2002.

REFERENCES :

1. Rao,J.S and Dukkipati, R.V, “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Ltd., 1992.
2. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 1989.
3. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 1989.
4. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw-Hill, 1980.
5. Burton Paul, “Kinematics and Dynamic of Planer Machinery”, Prentice Hall, 1979.

OUTCOMES:

- Students will be able to understand the fundamentals of mechanisms and their applications

- Students will be able to analyze the kinematic properties of mechanism such as displacement , velocity and acceleration.
- Students will be able study and analyze machinery such as cams and gears kinematically.
- Students will be able to understand the influence of friction in machines such as belt drives, clutches and brakes.
- Will have knowledge to analyze the different types of Vibration

MEB2213 BASIC MANUFACTURING PROCESSES **L T P C**
3 0 0 3

OBJECTIVE:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and plastics component manufacture

MODULE I METAL CASTING PROCESSES **8**

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell, investment casting –– Lost Wax process – Pressure die casting – Centrifugal casting –– Sand Casting defects - Inspection methods.

MODULE II FABRICATION PROCESS **8**

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding – Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – Tig welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding –– Flame cutting – Weld defects – Brazing and soldering process –– Filler materials and fluxes

MODULE III BULK DEFORMATION PROCESSES **7**

Hot working and cold working of metals – Forging processes – Open and close die forging – Characteristics of the process – Types of Forging Machines – Typical forging operations – Rolling of metals – Flat strip rolling – Types of Rolling mills – Shape rolling operations – Tube piercing – Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion – Principle of rod and wire drawing – Equipments used.

MODULE IV SHEET METAL FORMING PROCESSES **7**

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations –– Formability of sheet metal – Test

methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Explosive forming – Magnetic pulse forming – Peen forming – Super plastic forming – Process characteristics

MODULE V POWDER METALLURGY 7

Introduction – Methods of powder production – Compaction of metal powders – Equipment – Compaction – Sintering- Secondary and finishing operation – Application – Selective Laser Sintering – Economics of powder metallurgy.

MODULE VI FORMING AND SHAPING OF PLASTICS 8

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

Total Hours: 45

REFERENCES:

1. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promotors Pvt Ltd., Mumbai, 2007
2. Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2006
3. B.S.MegendranParashar & R.K..Mittal, Elements of Manufacturing Processes, Prentice Hall of India, 2003.
4. P.N. Rao, Manufacturing Technology,Tata McGraw-Hill Publishing Limited, IInd Edition, 2009
5. P.C. Sharma, S. Chand and Company, A Text Book of production technology, Xth Edition, 2008
6. Begman, John Wilely & Sons, Manufacturing Process, VIIIth Edition, 1999.

OUTCOMES:

- Gain comprehensive knowledge about different manufacturing processes.

AUB2213 MECHANICAL METALLURGY L T P C
3 0 0 3

OBJECTIVES:

- To expose the students with various constitutions of alloys and its effects on adding with steel and also processing of materials.
- To impart the ability to investigate, analyze and provide solutions to problems arising from metallurgical and materials engineering processes.
- To develop an overall sound knowledge of metallurgical and materials engineering

MODULE I METALLURGICAL FUNDAMENTALS AND CONSITITUTION OF ALLOYS 8

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number. Constitution of alloys – Solid solutions, substitutional and interstitial.

MODULE II PHASE DIAGRAMS 7

Phase diagrams- Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Lever Rule, Iron – Iron carbide equilibrium diagram- Development of Microstructure in Iron–Carbon Alloys

MODULE III FERROUS AND NON FERROUS METALS 8

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA - maraging steels – cast Irons- Gray, White malleable, Spheroidal Graphite. Copper and its alloys– Aluminium and its alloys - microstructure, properties and applications.

MODULE IV HEAT TREATMENT 7

Full annealing, normalising, hardening and tempering of steel, Austempering, martempering, Isothermal transformation diagrams, Continuous Cooling Transformation Diagrams, case hardening- carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening. Hardenability-Jominy end quench test

MODULE V STRENGTHENING MECHANISMS 8

Grain size strengthening, Solid solution strengthening, Strain hardening, Recovery Recrystallization, Grain Growth, Martensitic strengthening, Yield point phenomenon, dispersion strengthening, fibre strengthening, precipitation strengthening- simple problems

MODULE VI POWDER METALLURGY 7

Pressure compaction- Isostatic pressing, powder rolling, forging and extrusion, explosive compaction. Sintering, Hot pressing and Hot Isostatic Pressing , vacuum sintering, finishing operations – sizing, coining, repressing and heat treatment, Processing of nano materials

Total Hours:45

TEXT BOOK:

1. Syndney H Avner, “Introduction to Physical Metallurgy”, 2/E Tata McGraw Hill Book Company, 2007.

REFERENCES:

1. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised Indian Edition 2007.
2. Raghavan. V. Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd, 5th Edition 2007.
3. Kenneth G. Budinski and Michael K. Budinski “Engineering Materials”, PHI / Pearson Education, 8th Edition, 2007.
4. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.

OUTCOME:

- On completion of the course a student should capable of participating effectively in the main areas of the metallurgical and materials industry.

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:

1. Johnson, Arthur T., “Biology for Engineers”, CRC Press, FL, 2011.
2. Campbell and Recee, “Biology”, Pearson, Benjamin Cummins Pub. 8th edition, 2008.
3. Scott Freeman, “Biological Sciences”, Prentice Hall, 2002.

OUTCOMES:

After finishing this course students will be able to

- understand basics of biological processes, composition of cell contents
- understand applications of microbes in industrial manufacturing of proteins, antibodies and antibiotics.
- understand cloning and genetic engineering
- identify the genes in different genome (plants, microbes, animals, human) and compare the genes by bioinformatics approaches

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

OBJECTIVE:

- 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
  - o Prepared speech
  - o Impromptu speech
  - o Debate: Case studies - Attitude and Behavior: role play and exploration
  - o Ability to ask for help – communication and team work
- MANNERS AND ETIQUETTE
  - o Organization and Planning
  - o Time keeping
  - o Conduct in workplace
  - o Conscientiousness
  - o Work output
  - o Professionalism
  - o Motivation
- OWNERSHIP OF TASKS
- Adaptability/flexibility

Total Hours : 30

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. The 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.

OUTCOMES:

The students should be able to:

- Develop verbal communication skills
- Debate with other students confidently
- Communicate effectively their ideas

MEB 2215	MECHANICS LAB	L T P C 0 0 3 1

OBJECTIVE:

1. Measure forces due to dynamic imbalance of a rotating shaft.
2. Compute magnitudes and locations of balancing masses in two given planes.
3. Implement balancing masses.
4. Measure forces after balancing and assess the effectiveness of the balancing design

LIST OF EXPERIMENTS:

1. Governors - Determination of sensitivity, effort, etc. for watt, porter, proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of law's -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system Spring mass-system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficients for multidegree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel –system with lumped Moment of inertia
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

Total Hours:45

OUTCOMES:

- Ability to analyze kinematics of the three-dimensional particle motion in various coordinate systems: cartesian, natural and cylindrical.
- Understanding of the concepts of displacement, velocity and acceleration as vectors and how to determine them.
- Understanding of the notion of a force as a vector.
- Ability to understand concepts of kinetic, potential and mechanical energies and the concept of a conservative force.
- Understanding of the concepts of power and mechanical efficiency.
- Ability to analyze particle dynamics
- Ability to make a right decision related to a choice of the system of particles whose motion is to be studied.
- Ability to correctly draw the free-body diagram (FBD) for the system.
- Ability to write and solve Newton equations of motion for the system.
- Ability to use concepts of angular displacement, angular velocity and angular acceleration.
- Ability to draw a FBD for a system of rigid bodies.
- Ability to determine mass moment of inertia for some simple body geometries.
- Ability to use principles derived from Newton's second law, including Work & Energy.

MEB2216 MANUFACTURING PROCESSES LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

- To study the various components of machines like Lathe, Shaper and drilling machine
- To study the various Tools and work holding equipments used in basic manufacturing processes
- To practice on the various operations that can be performed in basic manufacturing process that includes lathe, shaper and drilling machine
- Students develop the knowledge of product development phases and experience working in teams to design and construct product prototypes.
- Introduction of Lathe, Shaper and Drilling Machines – Components of machines, cutting tools and work holding devices, Cutting tool nomenclature and chip formation

LIST OF EXPERIMENTS:

Lathe

1. Facing, Plain turning and step turning and Taper Turning
2. Single start V thread and knurling operation.
3. Drilling, Boring and internal thread cutting.

Shaper

4. Machining V Block and Slotting internal keyway cutting

Drilling

5. Five holes at a given pitch circle on a plate (Boring center hole, drilling and tapping in five holes)

Sheet Metal

6. Making of tray and funnel from sheet metal

Moulding

7. Preparation of sand mould of dumble and flange

Smithy practices

8. Round to hexagon and making a U bend from a straight rod.

Project work

9. Combined Skill (Each team has to make two components.)

Total Hours : 45

OUTCOMES:

- To have knowledge on common basic machining operations
- To equip with the practical knowledge required in the core industries.

MEB2104 MATERIAL TESTING LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES :

- To study the microstructure of various materials.
- To study and record various test methods.
- To correlate the results for application.

METALLURGY LAB EXPERIMENTS

1. Metallographic Examination-Demonstration and Practice
   a. Study of metallurgical microscope.
   b. Specimen preparation for micro structural examination-cutting, grinding, polishing, etching.
   c. Selections of etchants for various metals and alloys.
2. Identification of microstructures of Plain Carbon Steel, Tool Steel, Gray C.I, SG Iron, Aluminium, Brass, Bronze.
3. Heat treatment: Annealing, normalizing, hardening and tempering of steel-Hardness and its microstructure.
4. Study of microstructure of welded (HAZ) and cast component.
5. Hardenability test - Jominy End quench test.

MATERIAL TESTING LAB EXPERIMENTS

1. Tension test.
2. Compression test.
3. Torsion test.
4. Deflection test .
5. Impact test .
6. Double shear test.

Total Hours : 30

REFERENCES:

1. ASTM E3 - 01(2007) e1 Standard Guide for Preparation of Metallographic Specimens
2. ASTM E407 - 07 Standard Practice for Microetching Metals and Alloys
3. ASTM E7 - 03(2009) Standard Terminology Relating to Metallography

OUTCOME:

- To gain practical exposure in interpretation and analysis of microstructure of various materials

SEMESTER V

AUB3101 TWO WHEELERS AND THREE WHEELERS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To know and understand the constructional details, operating characteristics and design aspects of two wheelers and three wheelers

MODULE I THE POWER UNIT **8**

Two stroke and four stroke SI engine, merits and demerits, Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes, merits and demerits, scavenging efficiency. Scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system. Electronic ignition System. Starting system. Kick starter system.

MODULE II CHASSIS **7**

Main frame, its types. Chassis, types of chassis, front and rear axle and final drive .

MODULE III SUB-SYSTEMS **7**

Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

MODULE IV BRAKES AND WHEELS **8**

Drum brakes, Disc brakes, Front and rear brake links lay-outs. Spoked wheel, cast wheel.Disc wheel. Disc types. Tyres and tubes.

MODULE V TWO WHEELERS **7**

Case study of motor cycles, scooters and mopeds. Servicing and maintenance.

MODULE VI THREE WHEELERS **8**

Case study of Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance.

Total Hours : 45

TEXT BOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. Marshall Cavensih, Encyclopedia of Motor cycling, 20 Volumes, New York and London, 1989.
3. Bryaut,R.V., Vespa Maintenance and Repair series.
4. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

OUTCOME:

- The student will have a comprehensive knowledge about the functioning of two wheelers and three wheelers

AUB3102 DESIGN OF MACHINE ELEMENTS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

MODULE I INTRODUCTION **10**

Classification of design - Engineering materials and their physical properties as applied to design - Selection of materials - Factors of safety in design - Endurance limit of materials - Determination of endurance limit for ductile materials - Notch sensitivity Principle of design optimization - Future trends - CAD Euler's formula - - Rankine's formula - Tetmajer's formula - Johnson formula - Design of push rods and eccentricity loaded columns - Reduction of stress concentration.

MODULE II DESIGN OF SHAFTS **10**

Introduction - Material and design stresses - Design of axles - Design of shafts on the basis of strength - Design of shaft on the basis of rigidity - Design of hollow shafts –

MODULE III DESIGN OF SPRINGS **9**

Design of close coiled helical spring subjected to axial loading - Torsion of helical springs.

MODULE IV GEAR DESIGN **11**

Design considerations - strength of gear teeth - Lewis equation - Terminology of gears Dynamic tooth load - Design of spur gears - helical gears - herringbone gears - bevel gears and worm gears.

MODULE V FLYWHEELS **9**

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel - Turning moment diagram.

MODULE VI DESIGN OF BEARINGS **11**

Design of journal bearings - Ball and Roller bearings - Types of Roller bearings - Bearing life - Static load capacity - Dynamic load capacity - Bearing material - Boundary lubrication - Oil flow and temperature rise.

Total Hours: 60

TEXT BOOKS:

1. Jain,R.K., "Machine Design", Khanna Publishers, 1992.
2. Sundararaja Murthy, T.V., "Machine Design", Khanna Publishers, New Delhi, 1991.
3. Bhandari,v.B., "Design of Machine Elements", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

REFERENCES:

1. Hall Allen,S. & other, “Machine Design” , Schaum publisher Co., 1982.
2. Sigley, “Machine Design”, McGraw Hill,1981.
3. “Design Data Book “, PSG College of Technology, Coimbatore,1992

OUTCOME:

- The student will be capable of Designing Automobile Components like Shafts, Gears, Bearings and Flywheel

AUB3103	PETROL ENGINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the working principles and constructional details of petrol engines
- To learn about the auxiliary systems of automotive petrol engines

MODULE I ENGINE CONSTRUCTION AND OPERATION 8

Constructional details of four stroke petrol engine, working principle, air standard Otto cycle, actual indicator diagram, two stroke engine construction and operation, comparison of four stroke and two stroke engine operation, firing order and its significance. Port Timing, Valve Timing of petrol engines. Variable Cam timing , Twin indepentent Cam shafts

MODULE II SI ENGINE FUEL SYSTEM 8

Carburettor working principle, requirements of an automotive carburettor, starting, idling, acceleration and normal circuits of carburettors. Compensation, maximum power devices, constant choke and constant vacuum carburettors, fuel feed systems; mechanical and electrical fuel feed pumps. Petrol injection, MPFI. Inlet Air compression(Super charging), Gasoline Turbo Direct Injection

MODULE III IGNITION SYSTEM 7

Types and working of battery coil and magneto ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, electronic ignition systems. Ignition distributor

MODULE IV COOLING SYSTEM 7

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, forced circulation system, pressure cooling system.

MODULE V LUBRICATION SYSTEM 7

Lubrication system; mist, wet sump lubrication system, properties of lubricants

MODULE VI COMBUSTION AND COMBUSTION CHAMBERS 8

Combustion in SI engine; stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, detonation, effect of engine variables on

knock, knock rating. Combustion chambers; different types, factors controlling combustion chamber design.

Total Hours : 45

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L.Mathur and R.P.Sharma, “A course in Internal combustion engines”, Dhanpat Rai & Sons Publications, New Delhi, 2001.
3. K.K.Ramalingam, “Internal Combustion Engines”, Scitech Publications, Chennai, 2000.

REFERENCES:

1. Heldt P.M., “High Speed Combustion Engines”, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., “Internal Combustion Engines Analysis and Practice”, International Text Books Co., Scrantron, Pennsylvania - 1988.
3. William H.Crouse, “Automotive Engines”, McGraw-Hill Publishers, 1985.
4. Ellinger H.E., “Automotive Engines”, Prentice Hall Publishers, 1992.
5. John B.Heywood, “Internal Combustion Engine Fundamental”, McGraw-Hill, 1988.
6. Pulkrabek “Engineering Fundamentals of the Internal Combustion Engines”, Practice Hall of India, 2003.

OUTCOME:

- Students will gain knowledge about the working and constructional detail of petrol engines

MEB3213 METROLOGY AND MECHANICAL MEASUREMENTS L T P C
3 0 0 3

OBJECTIVES:

- To learn about the various linear and angular measuring instruments of various accuracies and ranges
- To learn about measuring systems for parameters like force, torque and temperature

MODULE I MEASUREMENT CONCEPT 8

Definition of metrology, General Concepts of measurement system-Units and standards-measuring instruments- sensitivity, readability, range of accuracy, precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration, interchangeability, traceability. Statistical concepts: Mean, Range, Variance and Standard deviation

MODULE II LINEAR & ANGULAR MEASUREMENT 7

Linear measuring instruments: Slip gauges, Tool Maker's microscope, limit gauges. Comparators: Mechanical, pneumatic and electrical types, applications. Angular measurements: -Sine bar, bevel protractor-Taper angle measurements-

MODULE III FORM MEASUREMENT 7

Form measurement- Measurement of screw threads- floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method- straightness, flatness and roundness measurements- surface finish-surface roughness tester.

MODULE IV LASER AND ADVANCES IN METROLOGY 7

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection. Machine Vision systems - principle and functions.

MODULE V FORCE, TORQUE AND TEMPERATURE MEASUREMENT 8

Response of Measuring System: Amplitude, Frequency and Phase - Force, torque measurement- mechanical, pneumatic, hydraulic and electrical type-

Flow measurement-Temperature measurement- bimetallic strip, pressure thermometers, thermocouples, electrical resistance thermister.

MODULE VI VIBRATION AND ACOUSTIC MEASUREMENT 8

Vibration measurement - Vibrometers and accelerometers, test methods and calibration- Acoustic Measurement- AE Parameters, principles of acoustic emission techniques ,- Advantages, limitations and applications.

Total Hours: 45

TEXT BOOKS :

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 1994.
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997.

REFERENCES :

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 1984.
2. Beckwith T.G, and R.D.Marangoni, "Mechanical Measurements", Addison Wesley, 1999.
3. Donald D Eckman, "Industrial Instrumentation", Wiley Eastern, 1985.
4. ASTME, "Hand book of industrial metrology" Prentice Hall of India,1988.
5. ASNT, "Nondestructive testing handbook Emission" Volme.5- Acoustic emission testing,1994.

OUTCOMES:

- Have sound knowledge about the various fundamental principles of measurement
- Capable of selecting suitable measurement technique for various applications

GEB3201 ENVIRONMENTAL SCIENCE AND ENGINEERING (Common for all branches) **L T P C 3 0 0 3**

OBJECTIVE:

- 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 II BIOLOGICAL 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:

1. Environmental Science (The Natural Environment and Human Impact), Andrew R. W. Jackson and Julie M. Jackson, Pearson Education Limited, Harlow, Essex, England, 2000.
2. Environmental Science (Working with the Earth), G Tyler Miller, Jr., Thomson Brooks/Cole, 2006.

REFERENCES:

1. Physical Geology, Earth Revealed, David McGeary and Charles C Plummer, WCB McGraw Hill, 1998.
2. Sustainability: A Philosophy of Adaptive Ecosystem Management, Bryan G. Norton, 2005.
3. Environmental Impact Assessment, Larry W. Canter, McGraw-Hill, 1996.
4. The Revenge of Gaia: Why the Earth is Fighting Back and How We Can Still Save Humanity, James Lovelock, Penguin UK, 2007.

OUTCOME:

- Student should have gained basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.

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

OBJECTIVE:

- To prepare the students for building their competencies and career building skills.

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
  - o Group discussions: Do's and Don'ts – handling of Group discussions – What evaluators look for.
  - o Interview – awareness of facing questions – Do's and Don'ts of personal interview.
  - o Selection of appropriate field vis-à-vis personality / interest.
  - o Preparation of Resume–Objectives, profiles vis-à-vis companies requirement.
  - o Enabling students to prepare for different procedures / levels to enter into any company – books / websites to help for further preparation.
  - o Technical interview – how to prepare and face it.
- Workplace skills
  - o Presentation skills
  - o Oral presentations
  - o Technical presentations
  - o Business presentations
  - o Technical writing
  - o Interpersonal 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:

The course will help the students to

- Develop team work skills
- Take part effectively in various selection procedures followed by the recruiters.

AUB3104 COMPUTER AIDED DRAFTING

L	T	P	C
0	0	3	1

OBJECTIVES:

- To familiarize with the various codes and specifications of BIS concerned with engineering Drawings
- To learn about Limits, Fits and Tolerances
- To learn to generate part models assembly of various machine components and systems using modeling packages
- To generate part and assembly models of actual Mechanical Products

INTRODUCTION TO AUTO CAD **9**

Getting into Auto CAD. Drawing Editor, Menus, Co-ordinator systems, Creating adrawing. Line input methods, Angle measures, Circle-5 methods, Unity commands.Organising a Drawing Area: Limits, Zoom all, Drawing Aids, Grid, Shape, Ortho,Function keys, Entity creation, Arc, Point, Polygon, Donut, Trace, Ellipse. EditingCommands: Erase, Object selection methods, U, Oops, Redo, Move, Copy, Mirror,Rotate, Scale, Array.Two-Dimensional geometrical construction curves – Projection of points – Projectionof solids – Three dimensional views of simple solids.

MODELING SOFTWARE APPLICATION **36**

Introduction of Modelling Software, Formatting of 2D and 3D objects.3D Part Modeling – Protrusion, cut, sweep, draft, loft, blend, rib, round, chamferEditing-Move, Pattern, Mirror Assembly- Creating assembly from parts-assembly constrains Conversions of 3D solid model to 2D drawing – different views, sections, isometric view and dimensioning Introduction to Surface Modeling Introduction to File import, Export – DXF, IGES, STL, STEP 3D Modeling of machine elements like Flanged coupling, screw, jack etc.,

NOTE: Any one of the 3D MODELING softwares like Pro/E, IDEAS, CATIA UNIGRAPHICS, AutoCAD to be used

Total Hours: 45

REFERENCES:

1. Bhatt .N.D. and PANCHAL.V.M. "Machine Drawing", Charotar Publishing House, 388001, 38th Edition, 2003.
2. K.R. Gopalakrishnan., "Machine Drawing", 18th Edition, 2004.
3. P.S.G. Design Data Book
4. Ellen Finkelstein, "AutoCAD 2004 Bible", Wiley Publishing Inc, 2003.
5. Sham Tikoo, "AutoCAD 2002 with Applications", Tata McGraw-Hili Publishing Company, New Delhi, 2002.

OUTCOME:

- The student will be capable of generating solid models and 2-D drawings of Products adhering to standards

AUB3105	ENGINE COMPONENTS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To able to understand the concepts of four and two stroke engines
- To assembling and dismantling the 4 and 2 stroke engines

LIST OF EXPERIMENTS :

1. Dismantling of 4 cylinder petrol engine.
2. Assembling of 4 cylinder petrol engine.
3. Dismantling of 6 cylinder diesel engine.
4. Assembling of 6 cylinder diesel engine.
5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
6. Study of ignition system components – coil, magneto and electronic ignition systems.
7. Study of engine cooling system components
8. Study of engine lubrication system components
9. Ovality and taper measurement of cylinder bore and comparison with standard specifications
10. Ovality and taper measurement of engine crank shaft and comparison with standard specification

Total Hours: 45

OUTCOMES:

- Able to study and assembling of all engines
- Able to dismantle the 4 and 2 stroke engines

MEB3216	METROLOGY AND MECHANICAL MEASUREMENT LAB	L	T	P	C
		0	0	3	1

OBJECTIVE:

- To gain the skill of using all measuring instruments and measuring systems to get the accurate measurements.

LIST OF EXPERIMENTS:

1. Calibration and Error analysis of measuring Instruments.
2. Measuring Instrument Fabrication:

   Fabrication of 0.2 mm accurate simple vernier caliper.

   Fabrication of 0.2 mm accurate simple Micrometer.

   Fabrication of simple strain guage load cell etc.

   Fabrication of simple strain guage load cell etc.
3. Complete all measurements including intricate internal details of the given component using standard equipments and by other measuring procedures (Quick setting compounds, moulds etc.).
4. Setting up of comparators for inspection (Mechanical / Pneumatic / Electrical).
5. Measurement of angle using Sine bar / Sine Center /Toolmakers microscope /Slipguage.
6. Measurement of taper using standard balls / rollers.
7. Measurement of straightness and flatness.
8. Measurement of thread parameters.
9. Measurement of gear parameters.
10. Measurement of radius and surface roughness.
11. Measurement of Temperature.
12. Measurement of Displacement, Force and Torque.
13. Measurement of Acoustic Emission.
14. Scanning the surface using Coordinate Measuring Machine (CMM).
15. Measurement using vision system.

16. Mini Project

Performing various measurements for a reengineering component.

Total Hours: 45

OUTCOMES:

- Students able measure various parameters like force ,Temperature and Torque etc.,
- Able to use CMM and vision system suitably to get accurate measuring results.

SEMESTER VI

AUB3211	**DIESEL ENGINES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES :

- To impart the knowledge on basic concepts on Automotive Diesel Engines and its various sub components along with its functions.

MODULE I DIESEL ENGINE BASIC THEORY **8**

Diesel engine construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel-air and actual cycle analysis. Diesel fuel. Ignition quality. Cetane number. Laboratory tests for diesel fuel. Standards and specifications.

MODULE II FUEL INJECTION SYSTEM **8**

Requirements – solid injection. Function of components –common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Mechanical and pneumatic governors. Fuel injector, Types of injection nozzle, Nozzle tests. Spray characteristics. Injection timing. Pump calibration. Pilot injection.

MODULE III AIR MOTION, COMBUSTION **7**

Importance of air motion – Swirl, squish and turbulence, Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting delay period. Knock in CI engines. Comparison of knock in CI & SI engines.

MODULE IV COMBUSTION CHAMBERS **7**

Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – objectives – Different types of combustion chamber. Combustion chamber. Combustion chambers for Homogeneous charge compression ignition systems – Dual and alternate fueled engine systems.

MODULE V SUPERCHARGING AND TURBOCHARGING **7**

Necessity and limitation – Charge cooling. Types of supercharging and turbocharging – Relative merits. Matching of turbocharger. Inter cooler, Inseries Twin turbo

MODULE VI DIESEL ENGINE TESTING AND PERFORMANCE 8

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Methods to improve engine performance – Heat balance – Performance maps. Hot testing of engines, Dynamometer type, Chassis dyno for emission test

Total Hours: 45

TEXT BOOKS:

1. Mathul M.L. and R.P. Sharma, Internal Combusion Engines, Dhanpa Rai Publication, Delhi, 2010.
2. Ganesan,V., Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.

REFERENCES:

1. Heldt,P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
2. Obert,E.F., Internal Combustion Engine analysis and Practice, International Text Book Co., Scranton, Pennsylvania, 1988.
3. Maleev,V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974. Dicksee,C.B., Diesel Engines, Blackie & Son Ltd., London, 1964.

OUTCOMES:

- Able to know the working of diesel engine systems and parts of various subsystems.
- Able to know the difference of petrol engine fuel injection systems and others.

AUB3212 DESIGN OF AUTOMOTIVE COMPONENTS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data

MODULE I PRINCIPLES OF DESIGN OF THERMAL SYSTEMS 11

Principle of similitude, Thermodynamic analysis of reciprocating engine cycles, Engine cycle processes, Heat balance, Engine performance characteristics, General Engine Design: Selection of bore to stroke ratio, Cycle of operation, Speed, Number of cylinders and cylinder arrangements

MODULE II DESIGN OF PRINCIPAL ENGINE COMPONENTS 10

Design of piston, piston ring, piston pin, connecting rod, crankshaft, flywheel

MODULE III DESIGN OF VALVE GEAR TRAIN 11

Effect of valve timing on engine performance, Time selection of valve, Cam profile construction, Design of valve spring, Design of camshaft, Design of valve gear train for variable valve opening

MODULE IV ENGINE VIBRATIONS 9

Dynamics of crank mechanism, Inertia forces, Torsion vibrations, Vibration damping,

MODULE V BALANCING 8

Engine balancing, Firing order, Cylinder arrangements for balancing,

MODULE VI DESIGN OF ENGINE SYSTEMS 11

Design of cooling system, radiator, water pump and fan, Computation of air cooling system Design of fuel system for CI engine, Governor design, Design of carburetor, Design of direct cylinder and port injection system for SI engine, Design of intake and exhaust system Engine friction and wear, Selection of lubricant, lubricating system, pump and filters.

Total Hours: 60

REFERENCES:

1. I. C. Engine & Air Pollution – E. F. Obert, Harper & Row Publishers, NewYork
2. Engine Design – Giles J. G., Lliffe Book Ltd.
3. Engine Design – Crouse, Tata McGraw Publication, Delhi
4. I.C. Engine - Maleev V. L., McGraw Hill Book, Co.
5. I. C. Engine – L. C. Litchy, International Student Edition
6. Design of Automotive Engine – A. Kolchin and V. Demidov
7. I. C. Engine – Heywood
8. SAE Handbooks

OUTCOME:

- The student will be capable of Designing Automobile Components like engine, valves and gear trains

AUB3213 AUTOMOTIVE ELECTRICAL AND ELECTRONICS **L T P C**
3 1 0 4

OBJECTIVES :

- To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, charging System, Ignition System, Lighting System and Dash – Board Instruments.

MODULE I BATTERIES **7**

Principle and construction of lead-acid battery. Characteristics of battery, rating, capacity and efficiency of batteries. Various tests on battery condition, charging methods. Details of modern storage batteries.

MODULE II STARTING SYSTEM **8**

Condition of starting Behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units. Care & maintenance of starter motor, Starter switches.

MODULE III CHARGING SYSTEM **8**

Function, Components of DC and AC Charging System for Automobile, construction, operating principle, characteristics, charging circuit controls – cut out, relays, voltage and current regulators, troubleshooting

MODULE IV IGNITION SYSTEM **8**

Types, construction & working of battery coil and magneto ignition systems. Relative merits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, Electronic Ignition system. Digital ignition system.

MODULE V LIGHTING SYSTEM **7**

Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light. Head light dazzling & preventive methods.

MODULE VI ACCESSORIES **7**

Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper system, Trafficator, wiring system. (Accessories) - Parking assit,Button starter, Satellite navigation, Distant to Empty

Total Hours: 45

TEXT BOOK:

1. Judge,A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.

REFERENCES:

1. Young, A.P. & Griffiths,L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.
2. Vinal, G.W., Storage Batteries, John Wiley & Sons Inc., New York, 1985. Crouse, W.H., Automobile Electrical Equipment, McGraw Hill Book Co. Inc., New York, 1980.
3. Spreadbury, F.G., Electrical Ignition Equipment, Constable & Co. Ltd., London, 1962.
4. Kholi,P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd., New Delhi, 1975.
5. Automotive Hand Book, fifth edition, Robert Bosch, Bently Publishers, 2003.

OUTCOME:

- Able to understand the working of various electrical and accessories system.

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:

1. Bhushan Y.K., "Fundamentals of Business Organisation and Management", Sultan Chand & Co., 2003.
2. Banga & Sharma "Industrial Engineering & Management", 11th Edition, Khanna Publications, 2007.
3. Khanna, O.P., "Industrial Engineering & Management", Dhanpat Rai Publications, 2004.
4. 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.

AUB3214	FUELS AND LUBRICANTS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand the fuel quality and constituents
- To work with the gaseous fuels
- To examine the flash and fire point of fuels

LIST OF EXPERIMENTS:

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. Testing of fuels - Ultimate analysis, proximate analysis
4. ASTM distillation test of liquid fuels
5. Aniline Point test of diesel
6. Calorific value of liquid fuel.
7. Calorific value of gaseous fuel.
8. Reid vapour pressure test.
9. Flash and Fire points of petrol and diesel.
10. Copper strip Corrosion Test
11. Cloud & Pour point Test.
12. Temperature dependence of viscosity of lubricants & Fuels by Redwood VisViscometer.
13. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
14. Ash content and Carbon Residue Test
15. Drop point of grease and mechanical penetration in grease.

Total Hours: 45

OUTCOMES:

- Students able to understand the concept of calorimeters and viscometers
- Able to know the pressure test apparatus

AUB3215	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To study the working principle of the various electrical and electronic subsystems of an automobile.

1. Verify logic gates (AND,OR, NAND, NOR, EX-OR)
2. Study of revolution counter circuit
3. Study of control of DC motors
4. LabVIEW basic programming (tank level control)
5. Implementation of half adder and full adder
6. Study of IC 555 timer for motor control
7. Characteristics of Silicon controlled rectifier (SCR)
8. Addition and Multiplication of 8 bit numbers using 8085
9. Stepper motor control using 8051.
10. Temperature monitoring using LabVIEW
11. Heating and ventilation control using LabVIEW.

Total Hours: 45

OUTCOME:

- "Students able to understand the working of various electronic and control devices used in automobiles.

AUB3216	FOUR WHEELER LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- The course enables the students to study the different types of chassis and its components.
- To familiarize and understand the constructional arrangements of different chassis system.
- To study the different Components are mounted in chassis and its measurement.

LIST OF EXPERIMENTS:

1. Study of front wheel geometry and wheel alignment.
2) Study of front axle, Constant Velocity joints and find what type of it is.
3) Study of rear axle with differential and find the axle ratios.
4) Study of various types of gear box used in four wheeler and find the gear ratio of given gear box.
5) Study of various types of steering system used in four wheelers and find the steering ratio.
6) Study of various types of steering gear box used in four wheelers and find gear ratio.
7) Study of various types of braking system used in four wheelers.
8) Study of transfer case used in all wheel and four wheel drives.
9) Study of various types of clutches used in four wheelers.
10) Study of drive train of four wheelers.
11) Study of construction of main frames of truck and car.
12) Study of different types of fuel feed pumps and fuel delivery system.
13) Study of Electrical System-Battery, Wiring, Lighting, Controls, Charging Battery, Entertainment, Starter motor, Viper motor, centralised locking etc.
14) Study of safety modules used in four wheelers.

OUTCOME:

- Able to understand the working of various subsystems of various types of automobiles.

AUB3217	MODELING AND ANALYSIS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To train the students for developing 2D, 3D and solid model of various components of automobiles.
- To train the students to analyze the characteristics of various structures under load

LIST OF EXPERIMENTS:

1. Two dimensional mechanisms.
2. Forward Vehicle Dynamics Two dimensional mechanisms and vehicle analysis.
3. Working Model 2D
4. Introduction to 3D vehicle design SOLIDWORKS.
5. Mechanisms, Door, Auto Body.
6. suspensions Simulations
7. Vehicle vibrations principles
8. Drive train dynamics
9. energy and momentum Forces and Moments 2D and 3D Computer models
10. Finite Element Modeling (FEA) and failure analysis Stress, deformation calculations

Total Hours: 30

OUTCOME:

- Able to develop the models of various subsystems and analyze these systems under various load conditions

SEMESTER VII

AUB4101 VEHICLE DYNAMICS

L	T	P	C
3	1	0	4

OBJECTIVE:

- To study the sources of vibrations and methods to reduce these vibrations for improving passenger comfort.

MODULE I INTRODUCTION **10**

Fundamentals of vibration, single degree of freedom, two degree of Freedom Multidegree freedom, free, forced and damped vibrations, modeling and simulationstudies, model of an automobile, magnification factor, transmissibility, vibrationabsorber.

MODULE II MULTI DEGREE FREEDOM SYSTEMS **10**

Closed and far coupled system, eigen value problems, orthogonality of mode shapes,modal analysis, forced vibration by matrix inversion.

MODULE III NUMERICAL METHODS **10**

Approximate methods for determining fundamental frequency, Dunkerleys lowerbound, Rayleighs upper bound, Holzer method for closed coupled system andbranched systems.

MODULE IV VEHICLE HANDLING AND STABILITY OF VEHICLES **10**

Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

MODULE V SUSPENSION, SYSTEMS **11**

Requirements, sprung mass frequency, choice of damper characteristics and suspension spring rate, calculation of effectivespring rate, vehicle suspension in fore and aft direction, roll axis and vehicle under the action of side forces.

MODULE VI WHEELS AND TYRES **9**

Types of wheel, wheel wopple, wheel shimmy, wheel balancing - recent, statics, dynamic - tyre - requirements, types, testing dynamics, charecterics, power consumed by a tyre.

Total Hours: 60

TEXT BOOKS:

1. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
2. Rao J.S and Gupta. K “Theory and Practice of Mechanical Vibrations”, Wiley Eastern Ltd., New Delhi -2, 2002.

REFERENCES:

1. Heldt.P.M -”Automotive Chassis”- Chilton Co., New York- 1992
2. Ellis.J.R - “Vehicle Dynamics”- Business Books Ltd., London- 1991
3. Giles.J.G.Steering - “Suspension and Tyres”, Illiffe Books Ltd., London- 1998
4. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
5. Gillespie T.D, “Fundamentals of Vehicle Dynamics”, SAE USA 1992.

OUTCOME:

- Have knowledge of the causes and the methods to reduce the vibrations in automotuve systems.

AUB4102 AUTOMOTIVE TRANSMISSIONS L T P C
3 1 0 4

OBJECTIVES:

- To study the working of various transmission system and components used in automobiles
- To study the working principle automatic transmission, Hydrostatic

MODULE I INTRODUCTION 10

Types of transmission, punction of transmission, Requirement of transmission system.

Different types of clutches, principle, Construction and torque capacity. Determination of gear ratios for vehicles. Different types of gearboxes such as Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox.

MODULE II VECHICLE PERFORMANCE 10

Power transmission to the wheels - four wheel drive transmission - performance of Automobile such as resistance to motions, tractive effort, engine speed, engine power, accelaration and transmission efficiency.

MODULE III HYDRODYNAMIC DRIVE 10

Fluid coupling - Principle of operation, Constructional details, Torque capacity, Performance characteristics and Reduction of drag torque. Hydrodynamic Torque converter - Principle of operation, Constructional details and Performance characteristics. Multistage torque converters. Polyphase torque converters. Converter coupling.

MODULE IV PLANETARY GEAR BOXES 10

Construction and operation of Ford – T-model gearbox, Wilson Gear box and Cotal electromagnetic transmission.

MODULE V AUTOMATIC TRANSMISSION APPLICATIONS 10

Need for automatic transmission, Principle of operation. Hydraulic control system for automatic transmission. Chevrolet “Turboglide” Transmission, Continuously Variable Transmission (CVT) – Types – Operations.

MODULE VI HYDROSTATIC AND ELECTRIC DRIVE SYSTEMS 10

Hydrostatic drive - Various types of hydrostatic systems, Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, Construction and Working of typical Janny hydrostatic drive. Electric drive - Principle of operation of Early and Modified Ward Leonard Control system, Advantages & limitations.

Total Hours: 60

TEXT BOOKS:

1. Heldt P.M – "Torque Converters"- Chilton Book Co.-1992
2. Judge, A.W., Modern Transmission systems, Chapman and Hall Ltd., 1990.
3. Newton and Steeds – "Motor Vehicle"- Illiffee Publisher- 2000.

REFERENCES:

1. Design Practices, passenger Car Automotive Transmissions- SAE Hand book-1994.
2. Crouse, W.H., Anglin, D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1992.
3. Heldt, P.M., Torque converters, Chilton Book Co., 1992.

OUTCOME:

- Will be able to design and analyse various components of automotive transmission system

AUB4103	ENGINE MANAGEMENT SYSTEM AND EMISSION CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To explain the principle of engines electronic management systems and different sensors used in the systems.

MODULE I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 8

Components for electronic engine management system, open and closed loop control strategies, PID ontrol, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines.

MODULE II SENSORS AND ACTUATORS 7

Inductive, Hall Effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

MODULE III SI ENGINE MANAGEMENT 8

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch Monojetronic, L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

MODULE IV CI ENGINE MANAGEMENT 8

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve.

MODULE V CONTROL OF EMISSIONS FROM SI AND CI ENGINES 7

Design of engine, optimum selection of operating variables for control of emissions, EGR, Air injector PCV system, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control. NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, driving cycles.

MODULE VI ENGINE EMISSION AND STANDARDS 7

Airpolution due to IC Engines, Euro I and Euro II Norms, Hydro carbon emissions – Crevic Volumes and Flow in crevice, leakage past to exaust valves, valve over lop, deposit on valves, oil on comparsion champer valves, carpon mono oxide emission, oxide of nytrogen, other emission aldehydes, sulfer, lead, posporus. Known -exhaust emission, modern emission control system, crank cas blow by.

Total Hours : 45

TEXT BOOKS:

1. William B.Ribbens, Understanding Automotive Electronics, 5th Edition, Butterworth, Heinemann, 1998.
2. Tom Weather Jr and Cland C.Hunter, Automotive Computers and Control System, Prentice Hall Inc., New Jersey, 1984

REFERENCES:

1. Diesel Engine Management by Robert Bosch, SAE Publications
2. Gasoline Engine Management by Robert Bosch, SAE Publications
3. Robert N Brady, “Automotive Computers and Digital Instrumentation”, A reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
4. Bechtold, “Understanding Automotive Electronics”, SAE, 1998.
5. T. Mellard, “Automotive Electronics System”, William Hienemann, London, 1987

OUTCOMES:

- Have knowledge about the sensors and actuators used in EMS.
- Able to know the CI and SI engine management systems.

AUB4104 VEHICLE MAINTENANCE LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVE:

- To study the various maintenance the reconditioning of vehicle parts.

EXPERIMENTS:

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Cylinder reboring - checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out.
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance.
12. Practice the following:
    - i) Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
    - ii) Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
    - iii) Wheel bearings tightening and adjustment
    - iv) Adjustment of head lights beam
    - v) Removal and fitting of tyre and tube

Total Hours: 45

OUTCOME:

- Able to understand the reconditioning and repairing of various components and subsystems of vehicles.

AUB4105	MANUFACTURING TECH & CNC LAB	L	T	P	C
		0	0	3	1

OBJECTIVES :

1. To study the various mechanisms available in the, milling ,gear hobbing and grinding machines
2. To study the various tools and work holding devices used in machining processes
3. To practice the basic machining operations performed in the special purpose machines
4. Students develop the knowledge of product manufacturing phases and experience working in teams to manufacture a product. Introduction of milling, gear hobbing and grinding machines

LIST OF EXPERIMENTS:

- Milling Machines
  1. Milling Polygon Surfaces
  2. Keyway Milling
- Grinding / Polishing
  3. Surface Grinding
  4. Cylindrical Grinding
- Machining Components for Assembly of different fits.
  5. Bush and Shaft
  6. Step turning with drilling using capstan lathe
- Gear Machining
  7. Gear Milling
  8. Machining using CNC vertical machining
  9. Machining using CNC turning tap
- Project work
  10. Combined Skill (Each team has to make one simple product)

Total Hours: 45

OUTCOMES:

- To have knowledge on common special machining operations
- To equip with the practical knowledge required in the core industries.

AUB4106 ENGINE TESTING AND EMISSION LAB

L	T	P	C
0	0	3	1

OBJECTIVES

- To study the various performance characteristics of both petrol and diesel engines
- To measure the various constituents of exhaust.

EXPERIMENTS:

1. Study and use of IC engine testing Dynamometers.
2. Study of 2 and 4 wheeler chassis Dynamometers.
3. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
4. Performance study of petrol engine at full throttle and part throttle conditions.
5. Performance study of diesel engine both at full load and part load conditions.
6. Morse test on petrol and diesel engines.
7. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
8. Head balance test on a Automotive diesel engine.
9. Engine tuning for performance improvement.
10. Testing of 2 and 4 wheelers using chassis dynamometers.
11. Study of NDIR Gas Analyser and FID.
12. Study of Chemiluminescent NOx analyzer.
13. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer.
14. Diesel smoke measurement.

Total Hours : 45

REFERENCES:

1. Giles,J.G., Vehicle Operation and performance, Illiffe Books Ltd., London, 1989.
2. BIS Code Books, IS-10000 series, 1988.

OUTCOMES:

- Able to test the dynamometers and signal analyzers
- Able to know about the FID and NDIR.

AUB4107	FABRICATION PROJECT	L	T	P	C
		0	0	3	1

OBJECTIVES:

To provide scope for combining various design and manufacturing knowledge and skills learnt towards product realisation.

COURSE DETAILS:

The students will design and fabricate a small system and subsystem and present the design produce, analysis and manufacturing method as a project report along with the product realised.

OUTCOME:

Will have the ability to design and fabricate small systems and subsystems.

PROFESSIONAL ELECTIVES

AUBX01	FINITE ELEMENT METHODS FOR AUTOMOTIVE APPLICATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand about the concept of Continuum Mechanics
- To Study about the 2D and 3D parametric elements
- To know the static and dynamic problems in FEA

MODULE I INTRODUCTION **9**

Review of various approximate methods in structural analysis, Stiffness and flexibility matrices for simple cases. Basic concepts of finite element method. Formulation of governing equations and convergence criteria.

MODULE II DISCRETE ELEMENTS **10**

Use of bar and beam elements in structural analysis. Computer implementation of procedure for these elements.

MODULE III CONTINUUM ELEMENTS **10**

Different forms of 2D elements and their applications for plane stress, plane strain and axi-symmetric problems. Consistent and lumped formulation. Use of local coordinates. Numerical integration.

MODULE IV 2D ISO PARAMETRIC ELEMENTS **10**

Definition and use of different forms of 2D elements. Computer implementation of formulation of these elements for the analysis of typical structural parts.

MODULE V 3D ISO PARAMETRIC ELEMENTS **10**

Definition and use of different forms of 2D elements. Computer implementation of formulation of these elements for the analysis of typical structural parts.

Total Hours : 60

TEXT BOOKS:

1. Segerlind.L.J., " Applied Finite Element Analysis ", Second Edition, John Wiley and Sons Inc., New York, 1984.

REFERENCES:

1. Bathe.K.J. and Wilson.E.L., " Numerical methods in finite elements analysis ", Prentice Hall of India Ltd, 1983.
2. Cook.R.D., "Concepts and Applications of Finite Element analysis ", 3rd Edition, John Wiley & Sons, 1989.
3. Krishnamurthy.C.S., " Finite Elements analysis ", Tata McGraw Hill, 1987.
4. Ramamurthi.V., " Computer Aided Design in Mechanical Engg. ", Tata McGraw-Hill, 1987.

OUTCOMES:

- Upon successful completion of this course, the student will be able to understand:
- Numerical methods involved in Finite Element Theory Definition of truss, beam, membrane, plate, and continuum elements
- Formulation of planar one-dimensional (truss and beam) elements having linear, quadratic, and cubic shape functions
- Global, local, and natural coordinates
- Formulation of planar, plane stress two-dimensional elements (rectangular and quadratic quadrilateral elements)
- Formulation of 3-dimensional elements (four-node tetrahedral and eight-node brick elements)
- Direct formulation and basic energy and weighted residual formulation of finite elements
- Procedures for performing and verifying FEA using commercial FEA software

AUBX02 TWO WHEELERS AND THREE WHEELERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the constructional details, operating characteristics
- To Understand design aspects of two wheelers and three wheelers

MODULE I THE POWER UNIT **8**

Two stroke and four stroke SI engine, merits and demerits, Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes, merits and demerits, scavenging efficiency. Scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system. Electronic ignition System. Starting system. Kick starter system.

MODULE II CHASSIS **7**

Main frame, its types. Chassis, types of chassis, front and rear axle and final drive .

MODULE III SUB-SYSTEMS **7**

Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

MODULE IV BRAKES AND WHEELS **8**

Drum brakes, Disc brakes, Front and rear brake links lay-outs. Spoked wheel, cast wheel.Disc wheel. Disc types. Tyres and tubes.

MODULE V TWO WHEELERS **7**

Case study of motor cycles, scooters and mopeds. Servicing and maintenance.

MODULE VI THREE WHEELERS **8**

Case study of Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance.

Total Hours : 45

TEXT BOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
3. Bryaut,R.V., Vespa Maintenance and Repair series.
4. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

OUTCOME:

- The student will have a comprehensive knowledge about the functioning of two wheelers and three wheelers

AUBX03	MODELING AND SIMULATION OF VEHICLE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of hardware and software
- To know about the computer drafting and modeling

MODULE I COMPUTER HARDWARE AND SOFTWARE **8**

Introduction - An overview of CAD - Computer fundamentals - Classification of computers – Data communication - Configuration of computer system for design - Design work stations - Interactive display devices - Input devices - Output devices - Computer software

MODULE II COMPUTER DRAFTIN AND MODELLING OF CURVES, SURFACES AND SOLIDS **7**

Graphical input techniques - Transformation in graphics - Drafting through level languages -Fundamental of 2D drafting - 3D drawings. Introduction - 3D geometry - Surface types - Conventions - Attributes - Geometry - Examples of surface modelling - Solid modelling.

MODULE III VEHICLE FRAME, SUSPENSION AND STEERING SYSTEMS **7**

Study of loads - moments and stresses on frame members. Computer aided design of frame for passenger and commercial vehicle - Computer aided design of leaf springs - Coil springs and torsion bar springs. Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering

MODULE IV FRONT AXLE **7**

Analysis of loads - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of bearings.

MODULE V CLUTCH AND GEAR BOX **8**

Torque capacity of clutch. Computer aided design of clutch components, Design details of roller and sprag type of clutches. Computer aided design of three speed and four speed gear boxes.

MODULE VI DRIVE LINE AND READ AXLE **8**

Computer aided design of propeller shaft. Design details of final drive gearing. Design details of full floating. semi-floating and three quarter floating rear shafts and rear axle housings.

Total Hours : 45

TEXT BOOKS:

1. Dean Averns, " Automobile Chassis Design ", Illiffe Books Ltd, 1992.
2. Radhakrishnan.P. and Kothandaraman.C.P., "Computer Graphics and Design", Dhanpal Rai & Sons, Delhi 1990.

REFERENCES:

1. Heldt.P.M., " Automotive Chassis", Chilton Co., New York, 1992.
2. Steeds.W., "Mechanics of Road vehicles", Illiffe Books Ltd., London, 1990.
3. Giles.J.G., Steering, "Suspension and tyres", Illiffe Books Ltd., London, 1988.
4. Newton, Steeds & Garret, "Motor vehicle", Illiffe Books Ltd., London, 1982.
5. Heldt.P.M., "Torque converter", Chilton Book Co., New York, 1982.
6. Giri.N.K. "Automobile Mechanics", Khanna Publisher, New Delhi, 1996.
7. Ramamurthi.V., "Computer Aided Design in Mechanical Engg"., Tata McGraw Hill, New Delhi, 1987.

OUTCOMES:

- Students able to focus of Automotive System Dynamics which is to introduce the fundamentals of vehicle dynamics and the performance indices and evaluation criteria of vehicles,
- Able to analyze the influence of vehicle configuration and design parameters on vehicle performance,
- Able to discuss the approach for predicting vehicle performance and to simulate and analyze vehicle performance as well. Through teaching and specific experiments.

AUBX04 VEHICLE BODY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To study the various design aspects of vehicle body for minimum drag and passenger comfort

MODULE I CAR BODY DETAILS **8**

Types: saloon, convertibles, limousine, estate car, racing and sports car. Visibility:regulations, driver's visibility, tests for visibility, methods of improving visibility and space in cars. Safety: safety design, safety equipments for cars. Car body construction; design criteria, prototype making, initial tests, crash tests on full scale model, Dummies and Instrumentation

MODULE II VEHICLE AERODYNAMICS **8**

Objectives. Vehicle drag and types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, Various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments.

MODULE III BUS BODY DETAILS **7**

Types: mini bus, single decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions. Constructional details: frame construction, double skin construction, types of metal sections used, Regulations, Conventional and integral type construction.

MODULE IV COMMERCIAL VEHICLE DETAILS **7**

Types of body; flat platform, drop side, fixed side, tipper body, tanker body, Light commercial vehicle body types. Dimensions of driver's seat relation to controls. Drivers cab design.

MODULE V BODY MATERIALS **8**

Steel sheet, timber, plastic, GRP, properties of materials; Corrosion, anticorrosion methods.

MODULE VI TRIM AND MECHANISMS **7**

Selection of paint and painting process. Body trim items. Body mechanisms.

Total Hours: 45

TEXT BOOK:

1. J.Powloski - “Vehicle Body Engineering” - Business Books Ltd, London -1989

REFERENCES:

1. Giles.J.C. - “Body construction and design” - Liiffe Books Butterworth & Co. - 1971.
2. John Fenton - “Vehicle Body layout and analysis” - Mechanical Engg. Publication Ltd., London – 1982.
3. Braithwaite.J.B. - “Vehicle Body building and drawing” - Heinemann Educational Books Ltd., London – 1977.

OUTCOMES:

- Able to understand the various aerodynamic forces acting on the vehicle body.
- Able to design the body to minimize the drag.
- Able to select suitable materials for vehicle body.

AUBX05 AUTOMOTIVE AERODYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Study the Automotive Aerodynamics
- At the end of this course, the student will have good exposure to Automotive Aerodynamics

MODULE I INTRODUCTION **5**

Scope - historical development trends - Fundamental of fluid mechanics - Flow phenomenon related to vehicles -External & Internal flow problem - Potential of vehicle aerodynamics.

MODULE II RESISTANCE AND PERFORMANCE OF VEHICLE **5**

Resistance to vehicle motion – Air, Rolling and Grad resistance - Performance – Fuel consumption and performance

MODULE III AERODYNAMIC DRAG OF CARS **8**

Cars as a bluff body - Flow field around car - drag force - types of drag force - analysis of aerodynamic drag - drag coefficient of cars - startegies for aerodynamic development - low drag profiles.

MODULE IV AERODYNAMIC DRAG OF CARS **7**

Front end modification - front and rear wind shield angle - Boat tailing - Hatch back, fast back and square back - Dust flow patterns at the rear - Effects of gap configuration - effect of fasteners.

MODULE V VEHICLE HANDLING **10**

The origin of forces and moments on a vechile - side wind problems - methods to calculate forces and moments - vehicle dynamics Under side winds - the effects of forces and moments - Characteristics of forces and moments - Dirt accumulation on the vehicle - wind noise - drag reduction in commercial vehicles.

MODULE VI WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC 10

Introduction - Principle of wind tunnel technology - Limitation of simulation - Stress with scale models – full scale wind tunnels - measurement techniques - Equipment and transducers - road testing methods – Numerical methods.

Total Hours: 45

TEXT BOOK:

1. Hucho.W.H., "Aerodynamic of Road vehicles", Butterworths Co. Ltd., 1997.

REFERENCES:

1. Pope. A., "Wind Tunnel Testing", John Wiley & Sons, 2nd Edition, New York, 1974.
2. Automotive Aerodynamic : Update SP-706, SAE, 1987.
3. Vehicle Aerodynamic, SP-1145, SAE, 1996.

OUTCOMES:

- Demonstrate knowledge and understanding of the essential facts, concepts and principles of incompressible flows including vortices and viscous effects, boundary layers, wing and diffuser aerodynamic characteristics.
- Demonstrate understanding of how aerodynamics affects the motorsport vehicle design and operation
- Demonstrate a critical awareness of the wind tunnel techniques used to analyse motorsport aerodynamic problems and apply these techniques and concepts to develop solution strategies for relevant wind tunnel simulations
- Demonstrate competence in analysing and evaluating the low speed aerodynamic characteristics of representative vehicles and components using acquired wind tunnel data, data sheets and fundamental principles

AUBX06 AUTOMOTIVE SAFETY SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Study the Automotive Safety system.
- At the end of this course, the student will have good exposure to Automotive Safety system.

MODULE I INTRODUCTION **5**

Design of the body for safety, energy equation

MODULE II VEHICLE STRUCTURE **6**

Engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

MODULE III SAFETY CONCEPTS **8**

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact

MODULE IV SAFETY CONCEPTS **8**

Seat belt, regulations, automatic seat belt lightener system, collapsible steering column, tilt able steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

MODULE V COLLISION WARNING AND AVOIDANCE **9**

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

MODULE VI V COMFORT AND CONVENIENCE SYSTEM **9**

Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system

Total Hours: 45

TEXT BOOK:

1. Powloski.J - “Vehicle Body Engineering” - Business books limited, London - 1969.

REFERENCES:

1. Ronald.K.Jurgen - “Automotive Electronics Handbook” - 2nd edition- McGraw-Hill Inc., - 1999.

2. Bosch - “Automotive Handbook” - 5th edition - SAE publication - 2000.

OUTCOMES:

- Understand active safety systems.
  - Understand the objectives of automotive safety.
  - Describe the concept of active safety systems.
  - Show a basic understanding of how antilock brakes and traction control contribute to automotive safety.
- Understand passive safety systems.
  - Understand the difference between active and passive safety systems.
  - Describe how the vehicle's structure absorbs impact in a crash.
  - Show an understanding of how vehicles are tested for occupant protection during side and rollover crashes.

AUBX07 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Study the Combustion Thermodynamics and Heat Transfer
- At the end of this course, the student will have good exposure to Combustion Thermodynamics and Heat Transfer

MODULE I INTRODUCTION TO COMBUSTION PROCESSES 6

Combustion in premixed and diffusion flames - Combustion process in IC engines.

MODULE II NORMAL COMBUSTION IN SI ENGINES 5

Stages of combustion - Flame propagation - Rate of pressure rise - Cycle to cycle variation

MODULE III ABNORMAL COMBUSTION IN SI ENGINES 6

Abnormal combustion - Theories of detonation - Effect of engine operating variables on combustion.

MODULE IV COMBUSTION AND KNOCK IN CI ENGINES 11

Droplet and spray combustion theory - stages of combustion - delay period - peak pressure - Heat release – Gas temperature - Diesel knock.

MODULE V HEAT TRANSFER IN IC ENGINES 11

Basic definitions - Convective heat traanfer - Radiative heat transfer - Heat transfer, temperature distribution and thermal stresses in piston - Cylinder liner - Cylinder head - fins and values.

MODULE VI EXPERIMENTAL INVESTIGATION OF COMBUSTION AND HEAT 6

Photographic studies of combustion processes - P-q diagram in SI and CI engines. Anemometry – Temperature measurement in piston - cylinder liner - cylinder head and engine valves.

Total Hours: 45

TEXT BOOKS:

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 1998.
2. Cengel, “Thermodynamics An Engineering Approach”, 3rd Edition – 2003, Tata McGraw Hill, New Delhi.

REFERENCES:

1. Holman.J.P., “Thermodynamics”, 3rd Edition McGraw-Hill, 1995.
2. Natarajan. E., “Engineering Thermodynamics” Anuragam Publications, Chennai, 2012

OUTCOMES:

- A complete understanding of the concepts underlying combustion and heat radiation processes in practical application such as furnace, boilers, and other combustion chambers.
- Basics of the combustion and heat radiation mathematical modelling and numerical simulation. Knowledge of the physical processes (fluid dynamics, heat and mass transfer) and chemical processes (thermodynamics and chemical kinetics) involved in combustion.

AUBX08	JET ENGINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the principles of operation of Jet Engines
- To Understand the design principles of aircraft power plants
- To study in detail about gas turbines, ramjet, fundamentals of rocket propulsion and chemical rockets

MODULE I FUNDAMENTALS OF GAS TURBINE ENGINES 7

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

MODULE II SUBSONIC AND SUPERSONIC INLETS FOR JET ENGINES 8

Internal flow and Stall in subsonic inlets - Boundary layer separation - Major features of external flow near a subsonic inlet - Relation between minimum area ratio and eternal deceleration ratio - Diffuser performance - Supersonic inlets - Starting problem on supersonic inlets - Shock swallowing by area variation - External declaration - Models of inlet operation.

MODULE III COMBUSTION CHAMBERS 8

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

MODULE IV NOZZLES 7

Theory of flow in isentropic nozzles - nozzles and choking - Nozzle throat conditions - Nozzle efficiency - Losses in nozzles- Over expanded and under - expanded nozzles - Ejector and variable area nozzles - Interaction of nozzle flow with adjacent surfaces - Thrust reversal

MODULE V COMPRESSORS 7

Principle of operation of centrifugal compressor - Work done and pressure rise - Velocity diagrams - Diffuser vane design considerations - Concept of

prewhirl, rotation stall and surge - Elementary theory of axial flow compressor - Velocity triangles - degree of reaction - Three dimensional - Air angle distributions for free vortex and constant reaction designs - Compressor blade design - Centrifugal and Axial compressor performance characteristics.

MODULE VI SUPERSONIC INLETS AND NOZZLES 8

Supersonic inlets - starting problem on supersonic inlets - shock swallowing by area variation - external declaration - models of inlet operation. Convergent nozzles and choking - over expanded and under - expanded nozzles - ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces - thrust reversal.

Total Hours: 45

TEXT BOOK:

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

REFERENCES :

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

OUTCOMES:

- An understanding of quasi-one-dimensional flow;
- An understanding of the generation of thrust in air-breathing engines and rockets;
- An ability to carry out simple performance analysis of subsonic and supersonic inlets;
- An ability to carry out overall performance calculations of turbojets, turbofans and turboprops

AUBX09 ALTERNATIVE ENERGY VEHICLE

L	T	P	C
3	0	0	3

OBJECTIVES

- To acquire knowledge of alternate fuels
- To understand the changes in the engine design for handling
- To understand various energy systems for use in the automobiles.

MODULE I INTRODUCTION **6**

Estimation of petroleum reserve "World Energy Scenerio, Energy Survey of India" – Need for alternate fuel – Availability of alternate fuels.

MODULE II ALCOHOLS **9**

Properties as engine fuels, alcohols and gasoline blends, performance in SI engine. Methanol and gasoline blends – Combustion characteristics in engines – emission characteristics.

MODULE III NATURAL GAS, LPG, HYDROGEN AND BIOGAS **9**

Availability of CNG, properties, modification required to use in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects.

MODULE IV VEGETABLE OILS **10**

Various vegetable oils for engines – Etherification – Performance in engines – Performance and emission characteristics.

MODULE V ELECTRIC POWERED VEHICLES **6**

Layout of an electric vehicle – advantage and limitations – Specifications – System component, Electronic control system – High energy and power density batteries – Hybrid vehicle – Solar powered vehicles. Fuel cell vehicles.

MODULE VI SOLAR POWERED VEHICLES **5**

Layout of a solar vehicle – advantage and limitations – Specifications – System component, Electronic control system for Solar powered vehicles

Total Hours: 45

TEXTBOOK:

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Maheswar Dayal, Energy today & tomorrow, I & B Horishr India, 1982.
3. Bechtold, R.L., Alternative Fuels Guide Book, SAE, 1997.

REFERENCES

1. Nagpal, Power Plant Engineering, Khanna Publishers, 1991.
2. Alcohols and motor fuels progress in technology, Series No.19, SAE Publication USA 1980.
3. SAE Paper Nos.840367, 841156, 841333, 841334.
4. The properties and performance of modern alternate fuels – SAE Paper No.841210.

OUTCOMES:

- Students use language to understand, develop and communicate ideas and information with others.
- Students select, integrate and apply numerical and spatial concepts and techniques.
- Students recognize when and what information is needed, locate and obtain it from a range of sources and evaluate, use and share it with others.
- Students use, select and apply technologies.
- Students describe and reason about patterns, structures and relationships in order to understand, interpret, justify and make predictions.

AUBX10 NOISE, VIBRATION AND POLLUTION CONTROL **L T P C**
3 0 0 3

OBJECTIVE:

- To acquire knowledge of Noise Vibration and Pollution Control for handling them and understand various use in the automobiles.

MODULE I INTRODUCTION TO VIBRATION **7**

Introduction, Causes and effects of vibration, vibration terminology, Equation of motion- Energy method, Rayleigh's method etc., Harmonic and periodic motions, Vibration standards, Single-DOF Free Vibrations, Multi-DOF Free Vibrations.

MODULE II VIBRATION INSTRUMENTATION AND ANALYSIS **8**

Vibration measurements – Vibration measurement parameters (displacement, velocity & acceleration), instrumentation –electrodynamics exciters – impact hammers, piezoelectric accelerometers, signal conditioning and amplification, filters, preamplifiers and power amplifiers, real time analysis, FFT analysis, structural frequency response measurement, modal testing of beams, Modal parameter (natural frequency, mode shape and damping) estimation techniques Relevance of vibration analysis, introduction to experimental modal analysis, Structural modal analysis, mode shapes, Euler's beam equation for natural frequency, Calculation of natural frequencies - Rayleigh method, Stodala method, machine diagnostics through vibration analysis.

MODULE III INTRODUCTION TO NOISE AND NOISE MEASUREMENT 8

Introduction, causes, effects, basic terms, Noise characteristics, Sources of noise, vehicular noise level, engine noise, transmission noise, brake squeal, structural noise, noise in auxiliaries, wind noises, wave equation, noise standards etc.

Sound and Noise parameters, propagation of sound & noise in various machinery's, noise measuring parameters, noise level measurement techniques, Noise level interpolation and mapping, noise measuring instruments.

MODULE IV NOISE CONTROL **7**

Mechanization of noise generation, noise control methodologies, noise control measures, environmental noise management, Road vehicle noise standards, Sound absorption by porous materials, silencer and suppression systems, Sound absorption, sound insulation, acceptance noise levels

MODULE V NOISE CONTROL **7**

Introduction, Pollutants, sources, formation of HC and CO in SI engines, NO formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on emission formation.

Introduction, physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers.

MODULE VI NOISE CONTROL **8**

NDIR analyzers, thermal conductivity and flame ionization detections, analyzers for NOx, gas chromatograph, Orsat apparatus, smoke meters - spot sampling and continuous indication types like Bosch, Hartridge.

Pollution control in SI and CI engines, design changes, optimization of operating factors, exhaust gas recirculation, fuel additives to reduce smoke and particulates.

Total Hours: 45

TEXT BOOKS:

1. N. L. Meirovitch, Elements of vibration Analysis, Mc Graw Hill New York, 1986.
2. J.P. Den Hartog, Mechanical Vibration, 4th edition, Mc Graw Hill, New York 1985
3. Irwin & Garf, Industrial Noise & Vibration Control.
4. Mechanical Vibration – S. S. Rao, New Age International (P) Ltd., New Delhi
5. Mechanical Vibration Analysis, P. Srinivasan, Tata McGraw Hill Pub. New Delhi
6. Springer and Patterson, Engine Emission, Plenum Press, 1990.

7. W.M. Crouse and A.L. Anglinm, Automotive emission control, McGraw Hill Co., New York 1993.

REFERENCES:

1. Harris, C. M. Handbook of Acoustical Measurements and Noise Control, Acoustical Society of America, 1998.
2. Beranek L.L. & Ver I.L., Noise and Vibration Control Engineering: Principles and Applications, 2nd edition, Wiley 2006
3. Leonard Meirovitch, Fundamentals of Vibrations, Mc Graw Hill New York
4. J.S. Rao and K. Gupta, Advanced theory of Vibration.Willey Eastern.1992.
5. Ganesan.V., Internal Combustion Engines, 2nd edition, Tata McGraw Hill Co, 2003.
6. Obert.E.F., Internal Combustion Engines, Harper and Row, 1982.
7. Taylor.C.F., Internal Combustion Engines, MIT Press, 1972.
8. Heywood.J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995

OUTCOMES:

- At the conclusion of the course you will be able to: Perform NVH analysis
- Evaluate and interpret NVH test results, identify vehicle noise and vibration root causes and recommend product development solutions integrate NVH control techniques at the design stage.
- Problem solving and decision making
- Advanced technical competence
- Professional legal and ethical standards

AUBX11 COMPOSITES MATERIALS FOR AUTOMOBILES **L T P C**
3 0 0 3

OBJECTIVES

- To learn the composite materials and its applications in automotive industry.
- At the end of this course, the student will have good exposure to composite materials and its applications in automotive industry.

MODULE I ITI INTRODUCTION **8**

Reinforcement – Fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fibre – Fabrication – Properties – Applications – Comparison of fibres – Particulate and whisker reinforcements. Matrix materials – Properties-Wettability – Effect of surface roughness – Interfacial bonding – Methods for measuring bond strength.

MODULE II POLYMER MATRIX COMPOSITES **8**

Polymer Matrix Composites -Types – Processing – Thermal matrix composites – Hand layup and spray technique, filament winding, Pultrution, resin transfer moulding, autoclave molding – Thermoplastic matrix composites – Injection molding, film stacking – Diaphragm forming – Thermoplastic tape laying. Glass fibre/polymer interface. Mechanical properties – Fracture. Applications.

MODULE III METAL MATRIX COMPOSITES **6**

Metal Matrix Composites Types. Important metallic matrices. Processing – Solid state, liquid state, deposition, Mechanical properties. Applications.

MODULE IV CERAMIC MATRIX COMPOSITES **6**

Ceramic matrix materials – Processing – Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques – CVD, CVI, sol gel process. Interface in CMCs. Mechanical properties – Thermal shock resistance – Applications.

MODULE V COMPOSITE STRUCTURES **9**

Fatigue – S-N curves – Fatigue behaviors of CMCs – Fatigue of particle and whisker reinforced composites – Hybrid composites – Thermal fatigue – Creep

Introduction to structures - selection of material, manufacturing and laminate

configuration -design of joints - bonded joints - bolted joints - bonded and bolted – laminate optimization.

MODULE VI AUTOMOTIVE APPLICATIONS 8

Drive Shafts, Suspension Arms, Wheels, Valve Guides, Clutch Plates, use of MMC in disc brakes, Mufflers and other applications

Total Hours: 45

REFERENCES:

1. Mathews F L and Rawlings R D, “Composite Materials: Engineering and Science”, CRC Press and Woodhead Publishing Limited, 2002.
2. Krishnan K Chawla, “Composite Materials Science and Engineering”, Springer, 2001.
3. Handbook of Composites – American Society of Metals, 1990.
4. Derek Hull, “An introduction to Composite Materials”, Cambridge University Press, 1988.

OUTCOMES:

By the end of the course, students should be able to:

- Understand the preparation, applications and type or reinforcement.
- Understand the composite manufacturing processes.
- Demonstrate understanding of different theories of adhesion
- Explain the effects of micro structural parameters on the properties of composite
- Able to calculate stress, strain and modulus for a given problem of unidirectional composite.
- Identify the steps involved in material selection process of composite.
- Identify some of the items needed for production fabrication.

AUBX12 VEHICLE COMFORT SYSTEM & ERGONOMICS **L T P C**
3 0 0 3

OBJECTIVES

- Understand the engineering principles that underpin the design of an automotive vehicle for the comfort of the occupants and other road users.
- Recognize the future direction of the design of comfort systems within the automotive engineering sector.
- Appreciate the role and use of comfort systems in automobile engineering.

MODULE I INTRODUCTION TO AUTOMOTIVE COMFORT SYSTEMS 9

Introduction to automotive comfort systems for both the vehicle occupants and other road users.I

MODULE II DESIGN, CONSTRUCTION AND OPERATION OF COMFORT SYSTEMS 7

Introduction to the design, construction and operation of comfort systems such as: NVH (noise, vibration and harshness) of chassis, engines and power train, ride quality and sound quality; heating, ventilation and air conditioning systems.

MODULE III DRIVER COMFORT 7

Driver comfort – seating, visibility, man-machine system, Psychological factors – stress, attention

MODULE IV PASSENGER COMFORT 7

Passenger comfort - Ingress and egress, spaciousness, ventilation, temperature control, dust and fume prevention and vibration.

MODULE V COMFORT AND CONVENIENCE SYSTEM 8

Steering and mirror adjustment – Central locking system – Garage door opening system – Tyre pressure control system – Rain sensor system – Environment information system.

MODULE VI VEHICLE ERGNOMICS 7

Introduction to human body, Anthropometrics and its application to vehicle

ergonomics and cockpit design. Ergonomic research methods / ergonomic audit, Practical work aimed at integrating design and ergonomics

Total Hours: 45

REFERENCES:

1. B.Peacock, Waldemar Karwowski; Automobile ergonomics. Publisher: CRC; 1st edition, 1993
2. Bosch, “Automotive Handbook”, 5th Edition, SAE publication, 2000.
3. Ronald.K.Jurgen, “Automotive Electronics Handbook”, 2nd Edition, McGraw-Hill Inc.,1999.

OUTCOMES:

- Describe the characteristics and importance of ergonomics in automotive design technology.
- Identify relevant automotive design standards with regard to ergonomics.
- Design a vehicle system based on automotive design standards with regard to ergonomics.
- Analyze vehicle design performance related to ergonomic aspect.

AUBX13 TRAFFIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce the students about various traffic engineering and management problems and their solutions.

MODULE I INTRODUCTION AND TRAFFIC CHRACTERISTICS 7

Objectives and scope of traffic engg. Organizational set up of traffic engg department in India; Importance of traffic characteristics; Road user characteristics; Vehicular characteristics; Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.

MODULE II TRAFFIC SURVEYS 7

Methods of conducting the study and presentation of the data for traffic volume study; speed study and origin and destination study. Speed and delay study. Parking surveys; On street parking; off street parking. Accident surveys. Causes of road accidents and preventive measures; Use of photographic techniques in traffic surveys.

MODULE III HIGHWAY CAPACITY 7

Importance. Space and time headway. Fundamental diagram of traffic flow. Relationship between speed; volume and density. Level of service. PCU. Design service volume. Capacity of non-urban roads. IRC recommendations. Brief review of capacity of urban roads.

MODULE IV TRAFFIC CONTROL 8

Types of traffic control devices. Traffic signs; general principles of traffic signing; types of traffic signs. Road markings; types; general principles of pavement markings. Design of rotary. Grade separated intersections. Miscellaneous traffic control aids and street furniture.

MODULE V SIGNAL DESIGN 8

Types of signals. Linked or coordinated signal systems. Design of signal timings by trial cycle method; approximate method; Webstor's method and IRC method

MODULE VI TRAFFIC REGULATION AND MANAGEMENT 8

Need and scope of traffic regulations. Regulation of speed; vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management. Traffic management measures: restrictions on turning movements; one way streets; tidal flow operations; exclusive bus lanes; traffic restraint; road pricing.

Total Hours: 45

TEXT BOOK:

1. Khanna S. K. and Justo C. E. G., “Highway Engineering”, Nem Chand Bros., Roorkee.

REFERENCES:

1. Kadiyali L. R., “Traffic Engg. and Transport Planning”, Khanna Publishers
2. Matson T. M., Smith W. S. and Hurd F. W., “Traffic Engineering”, McGraw Hill, New York.
3. Drew D. R., “Traffic Flow Theory”, McGraw Hill, New York.

OUTCOMES:

- Knowledge means the body of facts, principles, theories and practices that is related to a field of work or study. It is described as theoretical and/or factual knowledge;Skills means the ability to apply knowledge
- How to complete tasks and solve problems. They are described as cognitive (logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);
- Competence means the proven ability to use knowledge, skills and personal, social and methodological abilities in work or study situations and in professional and personal development. It is described in terms of responsibility and autonomy.

AUBX14 FUEL CELL TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To introduce the concept of fuel cells for use in automobiles, analyse the performance characteristics of the various components and compare them with the other powering devices.

MODULE I INTRODUCTION TO FUEL CELLS 8

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

MODULE II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS 8

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

MODULE III COMPONENTS OF FUEL CELL 6

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects

MODULE IV FUEL CELL PERFORMANCE 7

Membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

MODULE V FUELING 8

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

MODULE VI FUEL CYCLE ANALYSIS 8

Introduction to fuel cycle analysis – application to fuel cell and other competing

technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

Total Hours: 45

REFERENCES:

1. Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.
2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

OUTCOMES:

By the conclusion of this course, each student should

- Apply know-how of thermodynamics, electrochemistry, heat transfer, and fluid mechanics principles to design and analysis of this emerging technology.
- Have thorough understanding of performance behavior, operational issues and challenges for all major types of fuel cells.
- Identify, formulate, and solve problems related to fuel cell technology keeping in mind economic viability.
- Use the techniques, skills, and modern engineering tools necessary for design and analysis of innovative fuel cell systems.
- Understand the impact of this technology in a global and societal context.
- Develop enough skills to design systems or components of fuel cells.
- Be ready to begin a career as an engineer in companies developing fuel cell components and systems.

AUBX15 SIMULATION OF IC ENGINES

L	T	P	C
3	0	0	3

OBJECTIVES

- To learn the simulation techniques to estimate the performance and emission characteristics of IC engines.
- At the end of this course, the student will be able to understand the various simulation techniques for SI and CI Engines.

MODULE I INTRODUCTION 8

Introduction-Heat of reaction-Measurement of URP-Measurement of HRP-Adiabatic flame temperature, complete combustion in C/H/O/N Systems,

MODULE II ADIABATIC PROCESS 8

Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature-Isentropic changes of state.

MODULE III SI ENGINE SIMULATION WITH AIR AS WORKING MEDIUM 7

Deviation between actual and ideal cycle-Problems, IC engine simulation with adiabatic combustion, temperature drop due to fuel vaporization, full throttle operation-efficiency calculation, part-throttle operation, super charged operation

MODULE IV PROGRESSIVE COMBUSTION 8

SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance.

MODULE V SIMULATION OF CI ENGINE 7

Diesel Engine Simulation: Multi Zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, and simulation for pollution estimation.

MODULE VI SIMULATION OF NEW ENGINE CONCEPTS 7

Dual fuel engine, low heat rejection engine, lean burn engine, variable

compression ratio engine, homogeneously charged compression ignition engine, controlled auto ignition engine.

Total Hours: 45

REFERENCES:

1. Ganesan. V. Computer Simulation of spark ignition engine process, Universities Press (I) Ltd. Hyderabad, 1996.
2. Ramoss. A.L., Modelling of Internal Combustion Engines Processes, McGraw Hill Publishing Co., 1992.
3. Ashley Campbel, Thermodynamic analysis of combustion engines, John Wiley & Sons, New York, 1986
4. Benson. R.S., Whitehouse. N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

OUTCOMES:

After completing the course students must be able to describe:

- The combustion and emission formation in the spark ignited engine
- A turbo-supercharging systems from a performance perspective
- The combustion and emission formation in the diesel engine
- Different methods to reduce exhaust emissions from diesel engines, both in combustion and after treatment
- Mass forces and vibration of a single cylinder engine
- How the two-stroke engine works
- How pulses in inlet and exhaust systems affect cylinder filling
- Thoughts and reasoning in current engine development

AUBX16	OFF ROAD VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- At the end of this course, the student will be able to understand the various types of off road vehicles

MODULE I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES **8**

Power plants, chassis and transmission, Multiaxle vehicles.

MODULE II LAND CLEARING MACHINES **6**

Bush cutter, stampers, Tree dozer, Rippers.

MODULE III BULLDOZER **7**

Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types

MODULE IV MINING TRUCKS **7**

Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines.

MODULE V SCRAPERS AND GRADERS **9**

Scrapers, elevating graders, self powered scrapers and graders.

MODULE VI SHOVELS AND DITCHERS **8**

Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

Total Hours: 45

REFERENCES:

1. Abrosimov. K. Bran berg.A. and Katayer.K., "Road making Machinery", MIR Publishers, Moscow, 1971.
2. Wang.J.T., "Theory of Grand vehicles", John Wiley & Sons, New York, 1987.
3. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998

OUTCOME:

- Will have knowledge on the working and disighn issues of off road vehicle.

AUBX17 SURFACE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge of principle and practice of surface engineering and coating techniques

MODULE I TRIBOLOGY PROCESSES **7**

Introduction to tribology, Wear: Types of wear - adhesive, abrasive, oxidative, corrosive, erosive and fretting wear, roles of friction and lubrication and wear testing.

MODULE II PLATING PROCESSES **7**

Plating Processes: Fundamentals of electrodeposition, plating of nickel, chromium, tin and copper, pulsed plating, hydrogen embrittlement, plating adhesion, electroless plating, electrochemical conversion coating, selective plating for repair, plating properties, hard anodizing.

MODULE III HARDFACING PROCESSES **8**

SMAW, GTAW, GMAW, FCAW, SAW, PAW, Oxy-Acetylene Welding, Furnace fusing, Thermal -spray, flame spray processes - HVOF, Detonation gun and jet kote processes, hard facing consumables.

MODULE IV SPECIAL DIFFUSION PROCESSES **7**

Principle of diffusion processes – Boriding, Aluminising, Siliconising, Chromising, Sursulf - Selection of diffusion processes – Characteristics of diffused layer – micro structure and micro hardness evaluation – properties and applications.

MODULE V THIN FILM COATINGS **8**

Physical vapour deposition processes – Thermal evaporation - sputter coating - Ion plating – Chemical vapour deposition – reactive sputtering - TiC, TiN, Alumina, CBN, Diamond and DLC coatings. Structure, properties and applications.

MODULE VI HIGH ENERGY MODIFICATION AND SPECIAL PROCESSES **8**

Electron beam hardening/ glazing, Laser beam hardening / glazing ion inplantation, Composite surface created by laser and Electron beam. Surface cements, Wear tiles, Electro spark deposition, fused carbide cloth, thermal / chemical,Ceramic coatings, centrifugal cast wear coatings, Wear sleeves and Wear plates.

Total Hours: 45

REFERENCES:

1. William D. Callister, Materials Science and Engineering: An Introduction, 7th Edition, John Wiley & Sons, New York, 2007.
2. Yip-Wah Chung, Practical Guide to Surface Science and Spectroscopy, Academic Press, San Diego, CA, 2001.
3. Donald L. Smith, Thin-Film Deposition: Principles and Practice, McGraw-Hill, Boston, 1995.
4. Hornyak G. Louis, Tibbals, H.F., Dutta Joydeep, Fundamentals of Nanotechnology, CRC Press, Boca Raton, 2009.
5. Rao R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill, New York, 2001, TK7870.15. F86 2001.
6. William M. Steen, Laser Material Processing, Springer, New York, 2003, TS183.S73.

OUTCOMES:

1. fundamental knowledge on ware mechanisam and reduction techniques.
2. able to apply the concept of surface engineering and tribulogy for producing special surfaces.

AUBX18	ADVANCED MATERIAL TESTING & FAILURE ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES

- This course is designed for the to enhance their knowledge on importance and significances of material quality in service, their impact on component life, customers? satisfaction in performance.
- The student will have good exposure to Material Testing characterization and failure analysis.

MODULE I MATERIAL PROPERITES **7**

Mechanical Characterization: Mechanical Property characterization- Principles & characterization techniques related to tensile, compressive, hardness, fatigue, and fracture toughness properties. Deformation, Super plasticity Stress-strain diagram, Determination of YS, UTS, MoE, %E, %RA, Hardness testing, true stress-strain diagram, stretcher strain characteristics, effects of cold working, & n values, poisons ratio

MODULE II MECHANICAL TESTS **7**

Deep drawn quality of sheets, Impact test, bend test, shear test, Significances of property evaluation, SN curves and fatigue life, non-destructive testing, residual stress measurements, microscopy and scanning electron microscopy, EDAX / WDS analysis, corrosion testing, wear & tear characteristics, slow strain rate characteristics, thermal behaviors. Thermal Analysis: Principles and applications of thermal analysis.

MODULE III PROPERTIES OF PLASTICS, ELASTOMERS AND COMPOSITES **8**

Molecular weight distribution, MFI, HDT & VICAT softening point, cold temperature behaviors, Rheological behaviors, hardness and impact properties, identification of polymers, weathering characteristics, cyclic temperature test, flammability, VOC and odor test, scratch resistance test, metal composition analysis, RoHS analysis.

MODULE IV MATERIAL BEHAVIOURS – ELECTRICAL EFFECTS **7**

Electrical properties of Materials – Dielectric constant, electrical resistivity, wire harness test Mechanical behaviors, Electrical-Magnetic-Optical properties of ploymer nano-composites.

MODULE V MATERIAL BEHAVIOURS – EFFECTS 8

THermal properties of Materials – coefficient of thermal expansion & contraction, Thermal response, Fire retardancy, Chemical resistance.

MODULE VI INSTRUMENTAL TECHNIQUES 8

FTIR spectrometer, Thermal analyzer, X-ray analyzer, Optical emission spectroscopy, Ion Chromatography, Gas and Liquid Chromatography, High strain rate tester, Non-destructive instruments, etc. New innovations in testing and characterization, X-ray Diffraction, Electron microscope (SEM, TEM), Scanning probe microscopy (SPM, AFM), Spectroscopic methods (EDS, FTIR); Mechanical behaviors, Thermal response, Fire retardancy, Chemical resistance and Electrical-Magnetic-Optical properties of ploymer nano-composites.

Total Hours: 45

TEXT BOOK:

1. Dictionary of Materials and Testing, Second Edition by Joan Tomsic

REFERENCES:

1. Material Characterization: Introduction to Microscopic & Spectroscopic Methods by Yang Leng John Wiley & Sons (Asia) Pte Ltd.
2. ASM Handbook on Metals Handbook: Vol. 8 Mechanical Testing – 1978.

OUTCOMES:

- Understanding the relation between the machanical properties and their role in performance.
- Knowledge of evaluating various machanical properties.

AUBX19 ALTERNATE PROPULSION L T P C
3 0 0 3

OBJECTIVES:

- To develop an understanding of how air-breathing engines and chemical rockets produce thrust;
- an ability to do overall engine performance analysis calculations;
- an ability to carry out performance calculations for individual engine components;
- an ability to carry out performance analysis for chemical rockets; an understanding of elementary overall engine design considerations.

MODULE I PROPELLERS 8

Ideal Momentum Theory and Blade Element Theory and their relative Merits, Numerical Problems on the Performance of Propellers using Propeller Charts, Selection of Propellers, Fixed, Variable and Constant Speed Propellers, Prop-Fan, Material for Propellers, Shrouded Propellers Helicopter rotor in Hovering Performance.

MODULE II AIRCRAFT PISTON ENGINES 7

The Internal Combustion Engine Process, Brief Historical Sketch S.I and C.I. Engines, 4-Stroke and 2-Stroke Engines, Thermodynamics of Engine Analysis, Combustion Process, Air Standard Cycles, Various, Type of Arrangements or Multi-Cylinder Aircraft Engines, their Merits and Operational Efficiencies,

Intake and Exhaust Manifolds, Cooling and Lubrication Systems, Valve Timing and Arrangements, I.H.P., B.H.P and F.H.P, Engine Performance, Effect of Altitude, Power required and Power available, Supercharging, Preliminary Design of Aircraft Piston Engine.

MODULE III FUELS, COMBUSTION AND FLAME STABILITY 8

Liquid Fuels, Hydrocarbons, Gasoline, Starting Mixtures and Temperatures, Vapor Lock, other Liquid Fuels and Blends, Combustion Knock and Knock Rating, Carburetion and Fuel Injection, Ignition of the Charge, Ignition System, Gas Turbine Fuels, Solid and Liquid Propellants.

MODULE IV AIRCRAFT GAS TURBINE ENGINES 7

Air-Standard Brayton Cycle, Actual Gas Turbine Engine Cycle, Compressor and Turbine Efficiencies, Compressor Work and Turbine Work, Centrifugal and Axial type of Compressor, their Comparative Action, Relative Merits in Operations, Combustion Chambers: Various Arrangements, Simplex and Duplex Burners.

MODULE V STEADY 1D GAS DYNAMICS 8

Basics, Simple Flows: Nozzle Flow, Nozzle Design, Nozzle Operating characteristics for Isentropic Flow, Nozzle Flow and Shock Waves. Nozzle characteristics for some Operational Engines. Rayleigh Flow and Fanno Flow. Effect of Frictional Duct Length in Subsonic Flow and Supersonic Flow, Numerical Problems in 1D Flow.

MODULE VI INFLETS, NOZZLES AND COMBUSTION CHAMBERS 7

Subsonic Inlets: Pressure Recovery, Inlet Sizing Drag Flow Distortion. Supersonic Inlets: Total and Sonic State Points, A/A* Normal Shock based Internal Compression Inlets, Design Sizing and Performance.

Total Hours: 45

REFERENCES:

1. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 5th Edition, 1993.
2. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999.
3. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., “Gas Turbine Theory”, Longman Co., ELBS Edition, 1989.
4. Gorden, C.V., “Aero thermodynamics of Gas Turbine and Rocket Propulsion”, AIAA.

OUTCOMES:

Students who successfully complete the course will demonstrate the following outcomes through examinations:

- An understanding of quasi-one-dimensional flow;

- An understanding of the generation of thrust in air-breathing engines and rockets;
- An ability to carry out simple performance analysis of subsonic and supersonic inlets;
- An ability to carry out overall performance calculations of turbojets, turbofans and turboprops;
- An elementary understanding of combustors, afterburners, and exhaust nozzles;
- An understanding of axial flow compressors and turbines, and an ability to carry out flow and performance calculations for these;
- An ability to carry out simple flight performance calculations for rockets;
- An understanding of the fundamentals of chemical rocket performance;
- An understanding of how liquid and solid propellant rockets work.

AUBX20 TRACTOR AND AGRICULTURAL MACHINES

L	T	P	C
3	0	0	3

OBJECTIVE:

- The student will have good exposure to Tractors and form equipments

MODULE I GENERAL DESIGN OF TRACTORS **8**

Classification of tractors – Main components of tractor – Safety rules.

MODULE II CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION **8**

Tractor controls and the starting of the tractor engines – Basic notions and definition – Engine cycles – Operation of multicylinder engines – General engine design – Basic engine performance characteristics.

MODULE III ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR **8**

Cylinder and pistons – Connecting rods and crankshafts – Engine balancing – Construction and operation of the valve mechanism – Valve mechanism troubles.

MODULE IV COOLING SYSTEM OF A TRACTOR **7**

Cooling system – Classification – Liquid cooling system – Components,

MODULE V LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR **7**

Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters – Fuel pumps.

MODULE VI FARM EQUIPMENTS **7**

Working attachment of tractors – Farm equipment – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

Total Hours:45

TEXT BOOK:

1. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.

REFERENCES:

1. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor
2. MIR Publishers, 1972.

OUTCOMES:

- Comprehensive knowledge on the working of tractor and agricultural machines.
- Ability to identify cretical design issues in tractor and agricultural machine design

AUBX21	FLEET MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The student will have good exposure to Fleet management

MODULE I MANAGEMENT TRAINING AND OPERATIONS 9

Basic principles of supervising. Organising time and people. Job instruction training – Training devices and techniques – Drive and mechanic hiring – Driver checklist – Lists for driver and mechanic – Trip leasing – Vehicle operation and types of operation.

MODULE II VEHICLE MAINTENANCE 8

Scheduled and unscheduled maintenance – Planning and scope – Evaluation of PMI programme – Work scheduling – Overtime – Breakdown analysis – Control of repair backlogs – Cost of options.

MODULE III VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET 6

Cost of inventory – Balancing inventory cost against downtime – Parts control – Bin tag systems – Time management – Time record keeping – Budget activity – Capital expenditures – Classification of vehicle expenses

MODULE IV FLEET MANAGEMENT WITH COMPUTER CONTROLLING ACTIVITY 6

Fleet management and data processing – Data processing systems – Software. Models – Computer controlling of fleet activity – Energy management.

MODULE V SCHEDULING AND FARE STRUCTURE 9

Route planning – Scheduling of transport vehicles – Preparation of timetable, Costs, fare structure – Methods of fare collection – Preparation of fare table.

MODULE VI SCHEDULING AND FARE STRUCTURE 7

Schedules and sections – Registration of motor vehicles – Licensing of drivers – Control of permits – Limits of speed – traffic signs – Constructional regulations – Description of goods carrier, delivery man, tanker, tipper, Municipal, fire fighting and break down service vehicle.

Total Hours:45

TEXT BOOK:

1. John Dolu, Fleet management, McGraw Hill Co., 1984.

REFERENCES:

1. Government Publication, The Motor vehicle Act, 1989.
2. Kitchin, L.D., Bus operation, Illiffe and Sons Ltd., London, III Edition, 1992.
3. Kadiyali, L.R., Traffic engineering and Transport Planning.

OUTCOMES:

After successful completion of this course, the participants should be able to:

- Demonstrate an understanding of the requirement for fleet and transport management to be part of , logistics management.
- Define the relevant fleet and transport management concepts.
- Apply the principles of asset management in transport and fleet management.
- Demonstrate an understanding of the roles and responsibilities of the various officials.
- Apply the regulatory framework for government owned transport.
- Discuss the regulations applicable to the utilisation of government vehicles.

AUBX22 APPLIED HYDRAULICS AND PNEUMATICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- The student will have good exposure to Applied hydraulics and pneumatics

MODULE I FLUID POWER SYSTEMS AND FUNDAMENTALS 8

Introduction to fluid power, Advant ages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids - Fluid power symbols.

Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow - Reynold's number - Darcy's equation - Losses in pipe, valves and fittings.

MODULE II HYDRAULIC SYSTEM & COMPONENTS 8

Sources of Hydraulic Power: Pumping theory - Pump classification - Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance - Variable displacement pumps.Fluid Power Actuators: Linear hydraulic actuators - Types of hydraulic cylinders - Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators - Fluid motors, Gear, Vane and Piston motors. Construction of Control Components : Direction control valve - 3/2 way valve - 4/2 way valve - Shuttle valve - check valve - pressure control valve – pressure reducing valve, sequence valve, Flow control valve - Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram.

MODULE III DESIGN OF HYDRAULIC CIRCUITS 8

Reciprocation, quick return, sequencing, synchronizing circuits, simple industrial circuits- press circuits, earth movers, grinding machines. safety and emergency modules. Accumulators and Intensifiers : Types of accumulators - Accumulators circuits, sizing of accumulators, intensifier - Applications of Intensifier - Intensifier circuit.

MODULE IV PNEUMATIC SYSTEMS AND COMPONENTS 7

Pneumatic Components: Properties of air - Compressors - Filter, Regulator, Lubricator Unit - Air control valves, Quick exhaust valves, pneumatic actuators.

MODULE V PNEUMATIC SYSTEMS AND COMPONENTS 7

Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, Sequential circuit design for simple industrial applications using cascade method.

MODULE VI DESIGN OF PNEUMATIC CIRCUITS 7

Servo systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics - Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

Total Hours: 45

TEXT BOOKS :

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.

REFERENCES :

1. Majumdar S.R., "Pneumatic systems - Principles and maintenance", Tata McGraw Hill, 1995
2. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
3. Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey, 1976.
4. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5. Dudely A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

OUTCOMES:

- To know the fluid power ,advantages of fluid power ,application of fluid power system
- To know types of fluid power system, properties of hydraulic fluids ,general types of fluids

AUBX23	COMPUTER AIDED DESIGN AND MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The student will have good exposure to computer aided design and manufacturing

MODULE I INTRODUCTION **7**

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices. Computer Graphics: Raster scans graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

MODULE II GEOMETRIC MODELING **8**

Geometric modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired. Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling, constraint based modeling.

MODULE III COMPUTER AIDED MANUFACTURING **8**

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

MODULE IV COMPUTER AIDED PRODUCTION PLANNING **7**

Computer Aided Processes Planning, Material requirement planning, manufacturing resources planning,

MODULE V COMPUTER AIDED PRODUCTION GROUP TECHNOLOGY **8**

Part family, coding and classification, production flow analysis, advantages and limitations, Retrieval type and Generative type.

MODULE VI FLEXIBLE MANUFACTURING SYSTEMS 7

DNC, AGV, ASRS, Flexible manufacturing systems - FMS equipment, system layouts, FMS control.CIM: Integration, CIM implementation, major functions in CIM, Benefits of CIM, Lean manufacturing, Just-in-time.

Total Hours:45

TEXT BOOK:

1. CAD / CAM Principles and Applications - 2nd edition, P.N. Rao, Tata Mc. Graw Hill.

REFERENCES:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
4. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.

OUTCOMES:

Upon successful completion of all Computer-Aided Design certificate program requirements, graduates will

- Interpret complex engineering drawings including geometric dimensioning and tolerancing.
- Perform competently in solving technical manufacturing and engineering mathematics problems.
- Exhibit competency in two-dimensional, three-dimensional and solid-modeling skills as applied to complex computer-aided design technology.
- Demonstrate an understanding of the role and function of computers and effectively use the computer to solve complex technical problems.

AUBX24 STATISTICS AND QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

MODULE I STATISTICAL PROCESS CONTROL **8**

Statistical tools used in quality in SQC, Variation in processes, Control charts, Variables, Attributes, Establishing and interpreting control charts, X , R chart, p chart, c chart, u chart. Process capability, Analysis of process capability

MODULE II INTRODUCTION OF TQM **7**

Introduction - Need for quality - Evolution of quality - Definition of quality – Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

MODULE III TQM PRINCIPLES **8**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

MODULE IV TQM TOOLS & TECHNIQUES I **8**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

MODULE V TQM TOOLS & TECHNIQUES II **7**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss

function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

MODULE VI QUALITY SYSTEMS **7**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

Total Hours: 45

TEXT BOOK:

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

OUTCOMES:

On completion of this module the student will:

- Be able to explore the history and basic ideas underlying quality management and have a detailed knowledge of the role of Total Quality Management (TQM) in modern management.
- Demonstrate knowledge of quality management systems, their implementation and the practical steps needed for implementation.
- Be able to select and apply appropriate Specific Process Control (SPC) techniques and evaluate data generated.
- Demonstrate the ability to produce a quality manual.

- Have detailed knowledge of certification and accreditation.
- Have knowledge and insight of different quality management systems i.e. product quality management, safety and environmental management.
- Have knowledge of auditing and auditing systems.
- Be able to critique the current state of the artin Total Quality Management.

AUBX25 PROFESSIONAL ETHICS IN ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES

- To Identify the core values that shape the ethical behavior of an engineer.
- To Utilize opportunities to explore one's own values in ethical issues.
- To Become aware of ethical concerns and conflicts.
- To Enhance familiarity with codes of conduct.
- To Increase the ability to recognize and resolve ethical dilemmas.

MODULE I ENGINEERING ETHICS **8**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

MODULE II ENGINEERING AS SOCIAL EXPERIMENTATION **8**

Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

MODULE III ENGINEER'S RESPONSIBILITY FOR SAFETY **7**

Safety and Risk – Assessment of Safety and Risk – Risk Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl and Bhopal UNIT IV

MODULE IV RESPONSIBILITIES AND RIGHTS **8**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

MODULE V GLOBAL ISSUES **7**

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development.

MODULE VI ROLE OF ENGINEERS **7**

Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

Total Hours : 45

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics Concepts and Cases”, Thompson Learning, (2000).

REFERENCES:

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

OUTCOMES:

- Able to locate, describe, and apply the content of at least one example of a law (state, national, or international) dealing with engineering ethics.
- Able to locate, describe, and apply the content of the code of ethics/conduct of at least one professional society.
- Able to prepare, describe, and defend their own personal definition of what makes for an ethical engineer.

MEBX03 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS (Use of approved design data book is permitted)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the design of jigs and fixtures
- To study about the press working tools
- To know about the dies and their elements

MODULE I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES **8**

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis.

MODULE II JIGS **9**

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

MODULE III FIXTURES **9**

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures-Modular fixtures. Design and development of fixtures for given component.

MODULE IV PRESS WORKING TERMINOLOGIES **4**

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements.

MODULE V PRESS WORKING ELEMENTS OF DIES AND STRIP LAY OUT **6**

Elements of progressive combination and compound dies:Die block-die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers – knockouts-stops –pilots-Selection of standard die sets strip lay out-strip lay out calculations.

MODULE VI DESIGN AND DEVELOPMENT OF DIES **9**

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

Total Hours : 45

TEXT BOOKS:

1. Edward G Hoffman, “Jigs & Fixture Design”, Thomson – Delmar Learning, Singapore 2004
2. Donaldson. C, “Tool Design”, Tata McGraw-Hill, 1986

REFERENCES:

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978.
2. Joshi, P.H., “Jigs & Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004 Hiram E Grant, “Jigs and Fixture” Tata McGraw-Hill, New Delhi, 2003.
3. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
4. Design Data Handbook PSG College of Technology, Coimbatore.

OUTCOMES:

Upon completion of the subject, students will be able to

- Able to apply the basic principles in designing general jigs and fixtures, as well as molds and dies;
- Assess the performance of a given tool design for meeting the specific design criteria;
- Evaluate the effects of a given tool design on work quality.

MEBX07 NANO MATERIALS & FABRICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the principles of nano materials
- To study about the nano machining technique
- To understand about the inspection methods

MODULE I INTRODUCTION TO NANOMATERIALS 7

Amorphous, Crystalline, microcrystalline, quasicrystalline and nanocrystalline materials- historical Development of nano materials-problems in fabrication and characterization of nano materials.

MODULE II PRODUCTION OF NANOMATERIALS 10

Methods of production of nanomaterials, Sol-gel synthesis, Inert gas condensation, Mechanical alloying or high-energy ball milling, Plasma synthesis, and Electrodeposition.

MODULE III APPLICATION OF NANO MATERIALS 10

Applications in Electronics, Chemical, Mechanical engineering industries-Use of nanomaterials in automobiles, aerospace, defence and medical applications – Metallic, polymeric, organic and ceramic nanomaterials.

MODULE IV NANO FABRICATION TECHNIQUE 4

LIGA, Ion Beam Etching, - Nano fabrication Techniques, Quantum Materials.

MODULE V NANO MACHINING TECHNIQUE 4

Molecular Manufacturing Techniques, Nano Machining Techniques, Top down and Bottom up

MODULE VI INSPECTION OF NANOMATERIALS 10

Scanning Probe Microscopy (SPM)- Contact Mode, Tapping Mode, Scanning Tunnelling Mode (STM). Advanced Scanning Probe Microscopy – Electrostatic force Mode (EFM)- Magnetic Force Mode (MFM)- Scanning Thermal Mode (SthM), Piezo Force Mode (PFM). Scanning Capacitance Mode (SCM), Nanoidentation.

Total Hours : 45

REFERENCE:

1. Mark Ratner and Daniel Ratner, “Nano Technology”, Pearson Education, New Delhi, 2003.

OUTCOMES:

Upon successful students will:

- have a sound grounding and expert knowledge in multidisciplinary areas of nanoscience.
- have a sound grounding in and expert knowledge of the basic sciences relevant to employment or further study in the traditional sciences.
- have a grounding in economics and commerce relevant to the needs of high-technology companies.
- be prepared to work in a high tech work force or pursue a research higher degree in nanotechnology.
- analyse and critically evaluate ideas/information/data and apply relevant scientific principles to solve problems by, for example, creating hypotheses, testing theories and predictions, designing and carrying out experiments and analysing reported data.
- design and carry out experiments using both classical and novel science techniques and protocols.
- communicate their findings to a variety of audiences in written and spoken form through debates, posters, reports and oral presentations.
- appreciate that there are the relationships and connections across the sciences and non-science disciplines are core to nanotechnology and understand such relationships and connections.
- work and learn independently and appreciate the need for life-long learning.
- interact effectively as part of a team in order to achieve common goals.

MEBX09	MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of MEMS design
- To know about the design of Optical MEMS

MODULE I INTRODUCTION TO MEMS **8**

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS materials, Micro fabrication

MODULE II MECHANICS FOR MEMS DESIGN **8**

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

MODULE III ELECTRO STATIC DESIGN **8**

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inchworms, Electromagnetic actuators, Bistable actuators

MODULE IV CIRCUIT AND SYSTEM ISSUES **7**

Electronic Interfaces, Feed back systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Modeling of MEMS systems, CAD for MEMS.

MODULE V INTRODUCTION TO OPTICAL MEMS **7**

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices.

MODULE VI INTRODUCTION TO RF MEMS **7**

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital

Micro mirror devices. RF MEMS – design basics, case study – Capacitive RF MEMS switch, performance issues.

Total Hours : 45

TEXTBOOK:

1. Stephen Santeria," Microsystems Design", Kluwer publishers, 2000.

REFERENCES :

1. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton, 2000.
3. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

OUTCOMES:

- Describe new applications and directions of modern engineering
- Describe the techniques for building microdevices in silicon, polymer, metal and other materials.

MEBX12 PROCESS PLANNING AND COST ESTIMATION **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of Process planning and cost estimation.
- To learn the various statistical approaches for Cost estimation.
- To understand the Process planning tool for continuous process improvement.

MODULE I PROCESS PLANNING **10**

Definition – Objective – Scope – approaches to process planning- Process planning activities – Finished part requirements- operating sequences- machine selection – material selection parameters- Set of documents for process planning- Developing manufacturing logic and knowledge- production time calculation – selection of cost optimal processes – CAPP – Retrieval and generative type.

MODULE II COMPUTER AIDED PROCESS PLANNING **10**

Computer Aided Process Planning - Variant process planning - Generative process planning - Forward and backward planning, Logical Design of Process Planning - Implementation considerations -manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP

MODULE III INTRODUCTION TO COST ESTIMATION **7**

Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost- Material cost-Determination of material cost-Labour cost-Determination of labour cost - Expenses-Ladder of cost - Analysis of overhead expenses-Factory expenses – Depreciation - causes of deprecation – Methods of depreciation – Administrative Expenses – Selling Price Calculation.

MODULE III PRODUCTION COST ESTIMATION **8**

Estimation in Forging shop – Losses in Forging – Forging cost – Estimation in welding shop – Gas cutting – Electric arc welding – Estimation in Foundry shop – Estimation of pattern cost and casting cost.

MODULE IV ESTIMATION OF MACHINE TIME AND COST **5**

Estimation of machining time for lathe operation – estimation machining time for drilling, boring, shaping, planning milling and grinding operations.

MODULE V ESTIMATION OF MACHINE COST **5**

Estimation of machining cost for lathe operation – estimation machining cost for drilling, boring, shaping, planning milling and grinding operations.

Total Hours: 45

TEXT BOOK:

1. Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995.

REFERENCES:

1. Phillip.F Ostwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 1998
2. Russell. R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition, 2003.
3. Chitale. A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI, 2nd Edition, 2002.

OUTCOMES:

- Write, debug, and document well-structured Java applications of up to 500 lines
- Implement Java classes from specifications
- Effectively create and use objects
- from predefined class libraries
- Understand the behavior of primitive data types, object references, and arrays
- Use decision and iteration control structures to implement algorithms
- Write simple recursive algorithms
- Use interfaces, inheritance, and polym
- orphism as programming techniques

MEBX19 ADVANCED OPTIMIZATION TECHNIQUES **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the various optimization techniques and its applications.
- At the end of this course, the student will have good exposure to optimization techniques and its applications

MODULE I INTRODUCTION **8**

Statement of optimization problems – classification of optimization problem – classical optimization techniques; Single variable optimizations, Multi variable optimization, equality constraints, Inequality constraints, No constraints.

MODULE II LINEAR PROGRAMMING **8**

Graphical method for two dimensional problems – central problems of Linear Programming – Definitions – Simplex – Algorithm – Phase I and Phase II of Simplex Method – Revised Simplex Method.

Simplex Multipliers – Dual and Primal – Dual Simplex Method – Sensitivity Analysis – Transportation problem and its solution – Assignment problem and its solution by Hungarian method – Karmakar's method – statement, Conversion of the Linear Programming problem into the required form, Algorithm.

MODULE III NON LINEAR PROGRAMMING (Unrestricted search and Unconstrained Optimization) **7**

Introduction – Unrestricted search – Exhaustive search – Interval halving method – Fibonacci method.

Unconstrained Optimization – Introduction – Random search method – Uni variate method – Pattern search methods – Hooke and Jeeves method, Simplex method– Gradient of a function – steepest descent method – Conjugate gradient method.

MODULE IV NON LINEAR PROGRAMMING (Constrained Optimization) **7**

Constrained Optimization: Introduction – Characteristics of the problem – Random search methods – Complex method.

MODULE V DYNAMIC PROGRAMMING **8**

Introduction – multistage decision processes – Principles of optimality – Computation procedures.

MODULE VI DECISION MAKING **7**

Decisions under uncertainty, under certainty and under risk – Decision trees – Expected value of perfect information and imperfect information.

Total Hours: 45

REFERENCES:

1. Kalyanmoy Deb, “Optimization for Engineering Design, Algorithms and Examples”, Prentice Hall, 2004.
2. Hamdy A Taha , “Operations Research – An introduction”, Pearson Education, 2002.
3. Hillier / Lieberman, “Introduction to Operations Research”, Tata McGraw Hill Publishing Company Ltd, 2002.
4. Singiresu S Rao, “Engineering Optimization Theory and Practice”, New Age International, 1996.
5. Mik Misniewski, “Quantitative Methods for Decision makers”, MacMillian Press Ltd., 1994.
6. Kambo N S, “Mathematical Programming Techniques”, Affiliated East – West Press, 1991.

OUTCOMES:

Upon successful completion of this course, the student 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

MEBX20 ADVANCED PRODUCTION PROCESSES FOR AUTOMOTIVE COMPONENTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study about the powder metallurgy
- To understand the concepts of hydroforming process

MODULE I POWDER METALLURGY **8**

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts.

MODULE II FORMING PROCESS **8**

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets.

MODULE III HYDROFORMING PROCESS **7**

Hydroforming: Process, hydroforming of manifold and comparison with conventional methods – Hydro forming of tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

MODULE IV GEAR MANUFACTURING **8**

Different methods of Gear manufacture – Gear hobbing and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

MODULE V CONCEPT & PROGRAMMING OF CNC MACHINES **8**

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feed back devices – manual part programming – steps involved – sample program in Lathe & milling.

MODULE VI RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS **6**

Powder injection moulding – Shotpeen hardening of gears – Production of aluminium MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminium composite brake rotors.

Total Hours:45

TEXT BOOK:

1. Heldt,P.M., High Speed Combustion Engines, Oxford Publishing Co., New York, 1990.

REFERENCES:

1. Haslehurst,S.E., Manufacturing Technology, ELBS, London, 1990.
2. Rusinoff, Forging and Forming of metals, D.B. Taraporevala Son & Co. Pvt.Ltd., Mumbai, 1995.
3. Subroff, A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, New York, 1988.
4. High Velocity Forming of Metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.
5. Groover. M.P., Automatic production systems and computer integrated manufacturing, Prentice-Hall, 1990.
6. GE Thyer, Computer Numerical Control of Machine Tools, BH.Newners, 1991.

OUTCOMES:

- Able to analyze and solve complex technical problems related to mechanical environments through the application of engineering principles
- Able to design and analyze mechanical components, processes, and systems through the application of engineering principles and practices
- Able to analyze and prepare graphics and other technical documents to appropriate engineering standards.
- Able to use computer hardware and software to support the engineering environment

- Able to apply knowledge of manufacturing processes to the design of components
- Able to apply knowledge of materials and engineering principles to manufacturing operations and processes
- Able to apply knowledge of machinery, tools, and other equipment used in manufacturing processes
- Able to specify, coordinate, and conduct quality control and quality assurance procedures
- Able to recognize the environmental, economic, legal, safety, and ethical implications of mechanical engineering projects
- Able to use and maintain documentation, inventory, and records systems
- Able to participate in the management of an engineering project
- Able to develop strategies and plans to improve job performance and work relationships.

MEBX25 ADVANCED I.C. ENGINES

L	T	P	C
3	0	0	3

OBJECTIVE:

- At the end of the course, the students will be able to understand the significance of various processes in I.C Engines.

MODULE I INTRODUCTION **7**

Fuel air cycle and Actual cycle analysis, Properties of IC engine fuels, Refining process, chemical composition and molecular structure of fuels, octane number, cetane number. Knock rating of SI engine fuels.

MODULE II COMBUSTION OF FUELS **6**

Combustion Stoichiometry of petrol, diesel, alcohol and hydrogen fuels – Chemical energy and heating values – Chemical equilibrium and maximum temperature

MODULE III SI and CI ENGINE COMBUSTION **6**

SI engine combustion – Flame velocity and area of flame front –performance number – CI engine combustion. Fuel spray characteristics – droplet size, penetration and atomization.

MODULE IV COMBUSTION MODELLING **10**

Basic concepts of engine simulation, governing equations, simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

MODULE V NON-CONVENTIONAL IC ENGINES **8**

Adiabatic and L.H.R. engines – Variable compression ratio engine – Wankel rotary combustion engine – Free piston engine - MAN combustion chamber and multi fuel engines – Stratified charge and lean burn engines – Locomotive and marine engines.

MODULE VI COMBUSTION ANALYSIS IN IC ENGINES **8**

Photographic studies of combustion processes – P-? diagrams in SI and CI engines, Rate of heat release – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines

Total Hours: 45

TEXT BOOKS:

1. Ganesan .V - “IC Engines” - Tata McGraw-Hill, 2003.

2. John B. Haywodd, “Internal Combustion Engine Fundamentals”, McGraw-Hill Automotive Technology Series ISBN 0-07-1000499-8, 1988.

REFERENCES:

1. Ganesan .V – ‘Computer Simulation of Spark Ignition Processes’ - Universities Process Ltd, Hyderabad - 1993.

2. Ganesan.V. – Computer Simulation of compression ignition engines – Orcent Longman – 2000.

3. Richard Stone – “Introduction to IC Engines” – 2nd edition – Macmilan – 1992.

OUTCOME:

- The students will be able to safely and efficiently disassemble, inspect and re-assemble the engine, up to and including camshaft and crankshaft replacement.

MEBX28 COMPUTATIONAL FLOW AND HEAT TRANSFER **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the Boundary conditions of various FEA problems
- To study about the heat conduction of fluids
- To know about the convection and their significances

MODULE I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent flow - Turbulence -Kinetic -Energy Equations – mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

MODULE II DISCRETIZATION AND SOLUTION METHODOLOGIES 7

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method.

Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

MODULE III HEAT CONDUCTION 7

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

MODULE IV CONVECTION 8

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional convection and diffusion.

MODULE V CALCULATION OF FLOW FIELD 7

Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections -

Pressure - Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, Two equation (k-?) models.

MODULE VI DIFFUSION **8**

Finite volume formulation of steady one-dimensional Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional diffusion.

Total Hours : 45

TEXT BOOKS:

1. Versteeg, H.K, and Malalasekera, W., “An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, Longman, 1998
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw-Hill Publishing Company Ltd., 1998.

REFERENCES :

1. Patankar, S.V., “Numerical Heat Transfer and Fluid Flow”, McGraw-Hill, 1980. Ane- Books 2004 Indian Edition.
2. Muralidhar, K and Sundarajan .T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1995.
3. Bose, T.K., “Numerical Fluid Dynamics”, Narosa publishing House, 1997.
4. Muralidhar, K and Biswas “Advanced Engineering Fluid Mechanics”, Narosa Publishing House, New Delhi, 1996.
5. Anderson, J.D., “Computational fluid dynamics – the basics with applications”, 1995.

OUTCOMES:

After successfully completing this course you will be able to:

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

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:

1. Satender, "Disaster Management in Hills", Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), "Environmental Geography", Heritage Publishers, New Delhi,1990.
3. Savinder Singh, "Environmental Geography", Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., "The Environment as Hazards", Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), "Disaster Management", University Press, India, 2003.
6. Singh, R.B.,"Space Technology for Disaster Mitigation in India (INCED)", University of Tokyo, 1994.
7. Bhandani, R.K., "An overview on Natural & Manmade Disaster & their Reduction", IIPA Publication, CSIR, New Delhi, 1994.
8. 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:

1. Hari Singh Nalwa, "Handbook of Nanostructured Materials and Nanotechnology", Academic Press, 2000.
2. Guozhong Cao, "Nanostructures and Nano materials-Synthesis, Properties and Applications", Imperial College Press (2011).
3. Zhong Lin Wang, "Handbook of Nanophase and Nanomaterials (Vol 1 and II)", Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, "Nanotechnology: Basic Science and Emerging Technologies", Overseas press, 2005.

REFERENCES:

1. A. Nabok, "Organic and Inorganic Nanostructures", Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, "Nano Technology – Basic Science and Emerging Technologies", 1st Edition, Overseas Press, New Delhi,2005.
4. 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:

1. K. Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
3. C.J.Chesmond, "Basic Control System Technology", Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, "Control System Engineering", Wiley Eastern Ltd., Reprint, 1995.
5. 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:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCE:

1. 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:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. 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:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.

2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.

2. 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:

1. Charles S. Wasson, “System Analysis, Design, and Development: Concepts, Principles, and Practices”, Wiley Series in Systems Engineering and Management, 2006.
2. 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:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. 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:

1. Taha, H.A., “Operations Research - An Introduction", 9th Edition, Pearson Prentice Hall, 2011.
2. Winston.W.L. “Operations Research”, 4th Edition, Thomson – Brooks/Cole, 2003.
3. 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:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. 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:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 4th Indian Reprint, 2010.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. 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:

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, "The Management and Control of Quality", 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S., "Total Quality Management", Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.
5. 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:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. 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:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. 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:

1. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. 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:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human - Computer Interaction", John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, "Usability Engineering", Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Interaction", Pearson Education, 5th Edition, 2010.
2. 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:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. 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.