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

VISSION

The department of Automobile Engineering endeavours to become the centre of excellence for promoting intellect, creativity research and character in an active, student – centred learning community.

MISSION

- To provide quality Education to the students and to mold them as a professionals with good intellectual knowledge.

- The teaching methodology adopted here will develop our students to satisfy the need of world's scientific and humanistic enterprises.

- The learning process followed extends beyond class room teaching to activities like research, training and consultancy.

- All the members of the department including students, faculty and staff are encouraged to achieve excellence in their chosen fields and to share the responsibilities of citizenship and service in then global community.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
B.Tech. (Automobile Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

The Mission of the Automobile Engineering Program is achieved by student learning outcomes that prepare the graduate to be able to:

❖ Apply skills and understanding of engineering sciences with a foundation in mathematics, chemistry and physics necessary for engineering practice.

❖ Design and develop components, systems and products that meet specific requirements and use resources prudently in solving complex problems encountered in professional practice.

❖ Develop, test evaluate and execute engineering solutions to problems and projects that are practical and of a complexity encountered in professional practice.

❖ Design and conduct experiments; analyze results.

❖ Recognize and understand contemporary issues and the role of professionals in global society.

❖ Practice Professional and ethical responsibilities, including understanding of the societal impact of engineering solutions.

❖ Perform design individual and team-based project environments, providing leadership as necessary.

❖ Communicate and perform effectively as engineering professionals.

❖ Develop intellectually and technically through continued learning.

❖ Understand the continuing and life long learning practice.

PROGRAM OUTCOMES:

B. Tech Automobile Engineering Graduates will be able to

❖ Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- ❖ Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- ❖ Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- ❖ Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- ❖ Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- ❖ Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- ❖ Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- ❖ Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- ❖ Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- ❖ Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- ❖ Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- ❖ Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

- ❖ Select, design, model, analyze, fabricate, and test automobile components and sub systems.

❖ Work as a professional in automotive system design, validation, operation testing with emission measurement and control and maintenance of vehicle.

B.S.ABDUR RAHMAN
U N I V E R S I T Y
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

(With amendments incorporated till June 2016)

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
12. Biotechnology
13. Cancer Biotechnology
14. Food Biotechnology

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 training

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

For the 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)   The first semester Coordinator 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, 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.

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 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 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

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	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, admission to a hospital due to illness, etc.

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 should secure not less than 75% overall attendance in that semester taking into account the total no. of periods in all courses put together attended by the student as against the total no. of periods in all courses offered during that semester. If a student who could secure overall attendance between 65%

and 75% only in a particular semester due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level sports events with prior permission from the Officials concerned shall be given exemption from the prescribed attendance requirement and he / she shall be permitted to appear for the current semester examinations.

The students who do not fulfill the above attendance requirement will not be permitted to write the semester end examination and will not be permitted to move to next semester. Such students should repeat all the courses of the semester in the next Academic year.

15.2 The faculty member of each course shall furnish the cumulative attendance details to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less than 75% overall attendance, to the Dean (Academic Affairs) through the Head of the Department / School Dean. Thereupon, the Dean (Academic Affairs) shall issue orders preventing students from appearing for the semester end examination of all the courses of that semester.

15.3 A student who is awarded "U" 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 whenever the course is offered. 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, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

15.4 If a student with "U" grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will not be permitted to write the semester end examination and his / her earlier 'U' grade and continuous assessment marks shall continue.

16.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

16.1 All assessments of a course will be made on absolute marks basis. However, the Class Committee without the student 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 Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	--
AB	--

"W" denotes withdrawal from the course.

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

16.2 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.

16.3 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.

16.4 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 fee, through proper application to Controller of Examinations. HOD/Dean 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.

16.5 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 Redo 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.

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

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

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

"W" grades will be excluded for calculating GPA .

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

16.6 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 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 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.

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

17.1 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.

17.2 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 preceding or succeeding the project work, if offered.

18.0 PERSONALITY AND CHARACTER DEVELOPMENT

18.1 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.

19.0 DISCIPLINE

19.1 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.

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

20.0 ELIGIBILITY FOR THE AWARD OF DEGREE

20.1 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 dues to the Institution, Library, Hostels

iii) no disciplinary action pending against him/her.

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

21.0 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	English*				
		FRB1181	French*				
		ISB1181	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.	MS	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 and Microprocessor 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	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	SSB2181	Law for Engineers	3	0	0	3
7.	HS	ENB2282	Confidence Building & Behavioral Skills	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 and Three Wheelers	3	0	2	4
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 Skills	0	0	2	1
8.	EC	AUB3104	Computer Aided Drafting Lab	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

24

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	0	0	3
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
							23

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	AUB4104	Vehicle Maintenance Lab	0	0	3	1
8.	EC	AUB4105	Manufacturing Tech & CNC Lab	0	0	3	1
9.	EC	AUB4106	Engine Testing and Emission Lab	0	0	3	1
10.	EC	AUB4107	Fabrication Project	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	AUBX03	Modeling and Simulation of Vehicle Systems
3.	PE	AUBX04	Evaluation of Vehicle Performance
4.	PE	AUBX05	Automotive Aerodynamics
5.	PE	AUBX06	Automotive Safety Systems
6.	PE	AUBX07	Combustion Thermodynamics and Heat Transfer
7.	PE	AUBX08	Jet Engines
8.	PE	AUBX09	Alternative Energy Vehicle
9.	PE	AUBX10	Noise Vibration and Pollution Control
10.	PE	AUBX11	Composites Materials for Automobiles
11.	PE	AUBX12	Vehicle Comfort System & Ergonomics
12.	PE	AUBX13	Traffic Engineering
13.	PE	AUBX14	Fuel Cell Technology
14.	PE	AUBX15	Simulation of IC Engines
15.	PE	AUBX16	Off Road Vehicles
16.	PE	AUBX17	Surface Engineering
17.	PE	AUBX18	Advanced Material Testing & Failure Analysis
18.	PE	AUBX19	Alternate Propulsion
19.	PE	AUBX20	Tractor and Agricultural Machines
20.	PE	AUBX21	Fleet Management
21.	PE	AUBX22	Applied Hydraulics and Pneumatics
22.	PE	AUBX23	Computer Aided Design and Manufacturing
23.	PE	AUBX24	Statistics and Quality Management
24.	PE	AUBX25	Vehicle Body Engineering
25.	PE	AUBX26	Professional Ethics in Engineering
26.	PE	AUBX27	Modern and intelligent vehicle systems
27.	PE	AUBX28	Motorsport 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
18.	GE	GEBX105	Transport Management	Automobile
19	GE	GEBX214	Automotive Pollution Control	Automobile
20.	GE	GEBX	Vehicle Maintenance	Automobile
21	GE	GEBX	Motor Vehicle act,insurance and policy	Automobile

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 : 2e 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 ULTRASONICS 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 describe the fundamental and basic concepts of sociology.
- To illustrate how society evolved in India with changes in social strata.
- To explain the importance of groups, teams in industrial spheres.
- To develop the knowledge of social impact of economic liberalization and   technology.
- To state some basic concepts on ethics, values and human rights.
- To develop social responsibility &human professional ethics.
- To recognize and determine the role of engineers in the economic and social development of the society.

MODULE I   FUNDAMENTALS OF SOCIOLOGY   8

Sociology - definition, *evolution,* scope- Basic concepts-Social Process- Sociological theories, Social Institutions – family, economic, politics, religion, education, culture, Social Stratification , Socialization & Social Control.

MODULE II SOCIOLOGY IN INDIAN CONTEXT   7

Development – Institutions, caste & 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 – team enhancing group behavior. Industrial organization – formal and informal organizations, line and staff organizations - functions.

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-professional rights and responsibilities, 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 – Sustainable development – 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.
7. Haralambos, Heald R.M, Sociology Themes and Perspectives, Oxford, New Delhi-92
8. Ram Ahuja, Social Problems in India,Rawat Publications ,New Delhi

OUTCOMES:

On successful completion of this course,

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

- Students will have gained knowledge about the reality of the society.

- Students will be able to positively respond to the forces of change.

- Students will inculcate common interests of the group and adopt legitimate means to achieve them.

- Students will have knowledge about the impact of technology, modernization, and globalization.

- Students will be able to conform to the rules of the society and communicate effectively with the engineering community and with the society at large

- Students will work effectively as individuals, in teams and in multi-disciplinary settings together with the capacity to undertake holistic development of the 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	L T P	C
	LABORATORY	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	L T P	C
	& APPLICATIONS	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   7

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

Total Hours: 45

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 identify and present the basic concepts of demand, supply and equilibrium.
  - To explain and discuss the types and concepts of national income and inflation.
  - To illustrate the fundamental concepts of money, banking and exchange.
  - To create an awareness about the industrial sector, markets and trade and their contribution to economic development.
  - To describe the five year plans, budget, fiscal policy and taxation.
  - To appraise the students about Indian economy and justify 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

Role and functions of money -Monetary system –Money market- Role of Central Bank – Monetary policy – Commercial banks, Development banks - Capital market and Debt market.

MODULE IV INDUSTRY, LABOUR 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

Indian Economy – Development in the post independence era – Growth of the economy, Economic reforms – Liberalization, Privatization and Globalization - 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).
5. R.K. Lekhi, Public Finance, Kalyani Publishers.

6. D. M. Mithani, Money, Banking, International Trade and Public Finance, Himalaya Publishing House.

7. R.R. Paul, Monetary Economics, Kalyani Publishers.

8. Benson Kunjukunju and S. Mohanan, Financial System and Financial Institutions in India, New Century Publications.

9. Raddar Datt, K.P.M. Sundharam, Indian Economy, S. Chand.

10. Gregory Mankiw, Principles of Economics, Cengage Learning.

11. Gregory Mankiw, Principles of Microeconomics, Cengage Learning.

12. Uma Kapila, Indian Economy since Independence, Academic Foundation.

13. Andrew Gillespie, Business Economics, Oxford University Press.

14. Pindyck, Rubinfeld and Mehta, Microeconomics, Pearson.

15. C.B. Gupta, Business Environment, Sultan Chand and Sons.

OUTCOMES:

On successful completion of this course,

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

- Students will be able to identify the concepts of national income and inflation.

- Students will be able to apply the knowledge of money, banking and exchange in their real life situations.

- Students will have gained knowledge in government budget, economic planning and its implementation.

- Students will have an overview of the economic reforms introduced in Indian economy.

- Students will be able to analyze the importance of economics and apply the knowledge they have gained in their professional pursuits.

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 + 15

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 IVINDUCTION 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	L	T	P	C
	(FOR AUTOMOBILE ENGINEERING)	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. Electrode position 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**	**L T P**	**C**
	(Common for Mechanical, Aeronautical and	**0 0 3**	**1**
	Automobile Engineering)		

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

MAB 2181   **TRANSFORMS AND APPLICATIONS**   **L T P C**
                  (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:

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

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

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

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

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

OUTCOMES:

•   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		PC

| | | | 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	**L T P**	**C**
	(Use of standard Steam tables, Mollier diagram, Psychrometric chart is permitted)	**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

ECB 2181	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   06

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 TRANSISTORS AND AMPLIFIERS   08

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   09

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

MODULE IV COMBINATIONAL and SEQUENTIAL CIRCUITs   08

Combinational Circuits: Half and full adders- Magnitude Comparator- Sequential circuits: Flip Flops: SR, JK, D and T FF- Truth tables and circuits-Shift Registers

MODULE V 8085 MICROPROCESSOR   07

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

MODULE VI INTERFACING AND APPLICATIONS OF MICROPROCESSOR   07

I/O Interfacing: I/O mapped I/O and Memory mapped I/O - Intel 8255 PPI.-Applications of microprocessor: Stepper motor control & traffic light control

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.

OUTCOME:

•   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.

ECB 2182 ELECTRONICS AND MICROPROCESSOR LAB	**L T P C**
	0 0 3 2

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, ∇,μ, ,).

MODULE III NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 8

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

MODULE IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8

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

MODULE V NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8

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	**L T P C**
		3 0 0 3

OBJECTIVES:

• To Study 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 Actuators, 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:

On completion of the course student should be able to

- Select suitable frame for different vehicle with justification

- Select suitable steering system for different vehicles with justification.

- Analyze various drive line systems for automobiles.

- Select suitable wheels and tires with justification

- Evaluate the different types of suspension system for vehicle.

- Select and analyze different types of vehicle layouts.

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 understand 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:
On completion of the course the students should be able to

• Demonstrate the fundamentals of mechanisms and their applications

- Annalyze the kinematic properties of mechanism such as displacement , velocity and acceleration.
- Analyze machinery such as cams and gears kinematically.
- Analyze the effect of friction in machines such as belt drives, clutches and brakes.
- Demonstrate the balancing of any kinematic system
- Analyze the different types of Vibrations

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, X[th] 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 the students should be able to:

•   Analyze various crystal structures and constitutional alloys for different industrial components
•   Interpret and demonstrate phase diagrams.
•   Classify and analyze ferrous and non ferrous metals.
•   Evaluate various heat treatment processes.
•   Identify the different strengthening mechanisms with justification.
•   Evaluate various processes of powder metallurgy.

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

OBJECTIVES:

- To describe the Indian Constitution and Governance of our country.
- To appraise human rights, local and International and redressal mechanism.
- To explain the important aspect of corporate laws.
- To state the importance of industrial and labour laws of our country.
- To present the laws on contracts and arbitration.
- To state the importance of 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.   Jain M.P, Indian Constitutional Law, Wadhwa & Co., (2005)

2.   Subhash G. & Kashyap, Our Constitution : An introduction to India's Constitution and Constitutional Law, National Book Trust, 3rd edn., India (2001)

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

4.   Meena Rao, Fundamental Concepts in Law of Contract, 3rd edn., Professional offset, (2006).

5.   Ramappa, Intellectual Property Rights Law in India, Asia Law House (2010)

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

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

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

OUTCOMES:
On successful completion of the course

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have developed knowledge in judiciary, human rights, cultural, social and political rights.
- Students will have synthesized knowledge about the corporate and labour laws, contracts, arbitration and laws related to Intellectual Property Rights.

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

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:

- Measure forces due to dynamic imbalance of a rotating shaft.

- Compute magnitudes and locations of balancing masses in two given planes.

- Implement balancing masses.

- 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 AND THREE WHEELERS**   **L   T   P C**

                                                        3   0 2 4

OBJECTIVES:

- Gain the knowledge   about the   constructional and design aspects of two wheelers and three wheelers.
- Develop the ablity to know the operating characteristics two and three wheelers

- To create an experience to know the working principle and different types engine, transmission system of two and three wheelers

- To impart knowledge to the learners in the principles of working and operation and of various barking systems. brakes, wheels and tyres

- Enhance ability of the learners about working principles of electrical and electronic subsystem and sensors are using in two wheeler sand three wheelers.

MODULE I   INTRODUCTION   5

Classification and layout of two wheelers (Motorcycles, scooters mopeds) and Three wheelers, (Auto rickshaws, pickup van and delivery van) applications and capacity – goods and passengers; study of technical specifications of Two and Three wheelers;

MODULE II   POWER TRAIN   10

Selection of engine, Design considerations of power plants requirements for lubrication, cooling, starting, Recent engine developments, Clutch – requirements; different types -need of primary reduction, selection of transmission – gear transmission, gear shift mechanism, belt transmission, automatic transmission (Continuous Variable Transmission – CVT),final drive and differential for three wheeler;

MODULEIII STEERING AND SUSPENSION   7

Steering geometry, steering column construction; steering system for three wheelers, controls on handle bar of two wheelers. suspension requirements; design considerations; Front and rear suspension systems layouts. Springs and dampers

MODULE IV   BRAKES, WHEELS AND TYRES   8

Design consideration of brake; types of brakes: disc; drum; braking mechanism: mechanical; hydraulic and servo; ABS in two wheelers, Front and rear brake link layouts: wheel types Spoked wheel, cast wheel and Disc wheel; Tyre requirements details

MODULE V   FRAMES AND BODY   7

Types of frame; construction; loads acting on frame; design consideration; materials; three wheeler layout; aerodynamic; aesthetic and ergonomics considerations regulations.

MODULE VI SAFETY AND COMFORT   8

Handling characteristics; driver and pillion seating arrangement; ergonomics and comfort; road holding and vehicle stability; gyroscope effect; riding characteristics; safety arrangements; Racing bikes – special requirements.

Total Hours : 45

TEXT BOOK:

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

REFERENCES:

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

PRACTICAL SESSION: **Hours: 30**

1. Port timing diagram and Port area measurement for Two wheeler (Scooter) Engine and Three Wheeler (Auto rickshaw) Engine.
2. Dismantling and Assembling of two stroke petrol Engine (Zentap) with cubic capacity compression ratio and brake power measurements.
3. Dismantling and Assembling of four stroke petrol engine with cubic capacity compression ratio and brake power measurements.
4. Two and Three wheeler lightning and rooting system inspection and maintenance.
5. Inspection and Testing of Battery for various load condition including measurement of specific gravity.
6. Inspection service and Maintenance of Two and Three wheeler.
7. Removal refitting of wheels and tyres and measurement of aspect ratio and other dimension of the tyre.
8. Inspection and Measurement of pollution is Two and Three wheeler.
9. Actual compression ratio measurement of four stroke petrol Engine (150 cc).

OUTCOMES:

On completion of the course students should be able able to

- Extrapolate the constructional details of various types of two and three wheelers.
- Analyze the requirement and performance of the two and three wheelers transmissions systems.
- Summarize the construction of different types steering and suspension system.
- Demonstrate the construction details and design consideration of Braking system, wheel and tyres.
- Apply the basic element while develop a two wheeler frames and body.
- Develop comprehensive knowledge about the functioning of two wheelers and three wheelers and analyze the vehicle performance.

AUB3102   DESIGN OF MACHINE ELEMENTS   L T   P C
                                                          3   1   0 4

OBJECTIVES:

- To familiarize the various steps involved in the chassis design process.

- To be trained to use standard practices and standard data.

- To familiarize the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength   requirements.

- To learn to use catalogues and standard machine components.

MODULE I INTRODUCTION   10

Classification of design - Engineering materials and their physical propertiesas applied to design Selection of materials - Factors of safety in design -Endurance limit of materials - Determination of endurance limit for ductilematerials - Rankine's formula- Design for variable loading – Soderberg, Goodman and Gerber relations.

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

MODULE III DESIGN OF SPRINGS   10

Design of close coiled helical spring subjected to axial loading- Torsion of helical springs - Design of leaf springs - Laminated leaf springs – semi-elliptical leaf spring.

MODULE IV GEAR DESIGN   10

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

MODULE V CLUTCH DESIGN   10

Principle of operation- Types of friction materials- Single plate clutch- Multiplate clutch- Cone clutch- Energy dissipated due to clutch slip and the time required to reach full speed from rest during the acceleration period.

MODULE VI DESIGN OF BEARINGS   10

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 PublishingCo. 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

OUTCOMES:

On completion of the course a student should be able to:

- Evaluate the shape and dimensions of a component to satisfy functional and strength requirements.
- Design and analyze the various stresses acting on the shafts.
- Design various types of springs.
- Evaluate various types of forces, stresses and strains acting for different gears.
- Evaluate the different parameters in design of clutches.
- Design and analyze the various forces acting on different types of bearings.

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
• To learn about combustion process of petrol engine

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:

On completion of the course students should be able able to

*   Demonstrate an understanding of working concepts of various components of petrol engine and analysis of Otto cycle efficiency.
*   Evaluate the various components and principle of fuel system for SI engine.
*   Demonstrate an understanding of working principle of ignition system.
*   Analyze the cooling system for SI engine.
*   Evaluate various lubrication systems
*   Demonstrate combustion process and design a combustion chamber SI engine

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 :

•   Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 1984.

•   Beckwith T.G, and R.D.Marangoni, "Mechanical Measurements", Addison Wesley, 1999.

•   Donald D Eckman, "Industrial Instrumentation", Wiley Eastern, 1985.

•   ASTME, "Hand book of industrial metrology" Prentice Hall of India,1988.

•   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	**L T P**	**C**
(Common for all branches)	**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 LAB	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 – Projection of 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:

On completion of the course the students should be able to

- Generate solid models and 2-D drawings of products adhering to standards

- Generate part models assembly of various machine components and systems using modeling packages.

- Evaluate various codes and specifications of BIS concerned with engineering Drawings.

- Generate solid models and 3-D drawing for simple components

AUB 3105	ENGINE COMPONENTS LAB	L T P C
		0 0 3 1

OBJECTIVES:

Students should be able to understand the following

- Concepts and construction of 2 stroke and 4 stroke engines
- Construction and working of Intake , Exhaust , Ignition cooling and lubrication systems
- The significance of dimensional variation of cylinder bore, crankshaft, camshaft and connecting rod.

List of Experiments cylinder

1. Dismantling study and assembling of 4 cylinder SI engine

Measure the bore stroke, cubic capacity and compression ratio of a given 4 cylinder petrol engine. Compare the significance of cubic capacity with power. Identify the name, function and material of the components .

2. Dismantling study and assembling of 4 cylinder CI engine

To calculate the clearance volume and compression ratio of a 4 cylinder diesel engine. Measure the pressure in the cylinder at the end of compression stroke. Draw the motoring curve. Identify the name, function and material of the components.

3. Dismantling study and assembling of 2 stroke SI engine

Measurement of 2 stroke SI engine specifications Identification of Name function and material of of the components. Understanding of the following scavenging and short circuiting process, air cooling system.

4. Study of intake systems

Carburettor, TBI, MPFI and GDI for SI engine and DI, IDI and CRDI systems for CI engine . Identify the Name of components function material etc. Measurement of injector performance, Measurement of runner length of manifold and its significance.

5. Study of Exhaust systems

Exhaust system components like catalytic combater muffler, Identification of name of components function and material. Measurement of runner length of exhaust manifold and its significance.

6. Study of Ignition systems

Battery coil, magneto and Electronic Ignition systems. Identification of name and function material. Measurement of density of Electrolyte .

7. **Study of cooling systems**

Identification of name, function and material of the components. Measurement of discharge of water pump at various speed.

8. **Study of lubrication systems**

Identification of Name, function and material of the components. Measurement of discharge of oil pump at such pressure for difference speeds.

9. **Measurement of dimensional variation of cylinder block and gudgeon pin**

Measurement on cylinder block – cylinder bore, crankshaft bore and camshaft bore for taper and

ovality

Measurement of gudgeon pin, diameter and taper

Analysis of the impact of dimensional variation on engine performance

10. **Measurement of dimensional variation of Crankshaft, camshaft, connecting rod**

Measurement of crankshaft journal and pin for taper and ovality

Measurement of camshaft journal taper and ovality and cam lift.

Measurement of connecting rod big end and small end bores for taper and ovality.

Analysis of the impact of dimensional variation on engine performance

PROJECT TITLES:
1. Selection and coupling of suitable I.C. Engine to run a system
2. Measurement of Air intake and calculation of volumetric efficiency
3. Measurement of fuel intake and calculation of energy of the fuel metered
4. Making a working model of CDI system
5. Measurement of Exhaust pressure and calculation of exhaust quantity
6. Working model of Electronic ignition system
7. Working model of lubrication system
8. Working model of cooling system
9. Working model of Rocker arm mechanism
10. Working model of a CRDI system
11. Working model of a MPFI system
12. Working model of variable valve timing.
13. Energy recovery from exhaust system

14. Turbo charger model.

OUT COMES:

On completion of the course the students should be able to

1. Select suitable engines for different applications
2. Analyze the effect of various parameters on engine performance
3. Suggest modification to improve engine performance
4. Analyze the cause for poor or drop of performance of engine
5. Perform tests to tune the performance of engine components

MEB3216	METROLOGY AND MECHANICAL	L T P	C
	MEASUREMENT LAB	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.

B.Tech. Automobile Engineering

SEMESTER VI

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

OBJECTIVES :

• To learn the knowledge on basic concepts on Automotive Diesel Engines and its various sub components along with its functions.
• To learn combustion process of diesel engine and design of combustion chamber
• To learn the concept of supercharging and turbo charging.
• To understand the performance testing of diesel engines.

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:

On completion of course the students should be able to,

•   Demonstrate the working concepts of various components of Diesel engine
•   Analyze Diesel cycle efficiency.
•   Analyze and prepare a layout of fuel system for various diesel engine.
•   Demonstrate combustion process and design a combustion chamber in CI engine.
•   Analyze the performance of supercharger and turbocharger.
•   Analyze the engine performance characteristics.

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 GENERAL CONSIDEARTIONS IN ENGINE DESIGN   10

Auto Design –Some aspects of design - Modelling – Creative design – Designer – Design procedure – Effect on a design – Basic requirements – Classification of designs – Principles of good economic design.

MODULE II DESIGN OF PISTON   10

Piston qualities, Materials for piston- Design of piston- Types of piston rings, Design of piston ring- Design of piston pin.

MODULE III DESIGN OF CONNECTING ROD   10

Connecting rod – types, Materials for connecting rod - Design of connecting rod.

MODULE IV DESIGN OF VALVES,CAM, CAMSHAFT AND CRANKSHAFT   12

Design of camshaft- Valve design, Design of crankshaft- Design of crank pin

MODULE V DESIGN OF FLYWHEEL   10

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- Balancing of flywheel.

MODULE VI   DESIGN OF ENGINE FUELS SYSTEMS   10

Design of fuel injection system- Requirements of fuel injection system, Work of injection Design of Carburettor- Air flow, Fuel flow, Design of supercharging- Design of Governor.

Total Hours: 60

REFERENCES:

1. 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

OUTCOMES:

On completion of the course students should be able to

- Illustrate various design aspects and design procedures.
- Design pistons and piston pins.
- Design Camshaft, crankshaft and flywheel.
- Design fuel injection systems, carburettor, supercharger and governor.
- Evaluate the shape and dimensions of a component to satisfy functional and strength requirements.
- Evaluate the various forces, stresses and strains acting on the different engine components.

AUB3213	AUTOMOTIVE ELECTRICAL AND ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To learn about working principle and different types battery used in automobile.
- To impart knowledge to the students in the principles of operation and construction sal of starting system and charging systems.
- It has ignition, lighting and wiring. This provide fundamental knowledge to students
- To impart knowledge to students about working principles of electrical and electronic subsystem and sensors are using in automobile.

MODULE I BATTERIES 6

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 AND CHARGING 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. 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 III 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 IV LIGHTING SYSTEM AND WIRING CRCUTE 9

Head light dazzling & preventive methods. Standard lighting sources; energy demand; headlight and its construction; head light beam; headlight dazzle; anti-dazzle devices; bulbs and wattages; headlight adjustments; fog lamps; side and tail light; brake warning lights; LED lighting system; electrical switches; indicating and wiring devices; electrical pumps; heater and defrosters; latest trends; wiring and installation; auto cables; cable colours; cable connectors; wiring harnesses; circuit breakers; fuses; printed circuits; plastic fibre optics; trouble shooting

MODULE V   SENSORS, ACTUATORS AND CONTROLS   8

Types of sensors ; location in a vehicle, and working; Sensors ; speed sensors, Temperature sensors, flow sensors, pressure sensors, Solenoids, stepper motor, relay; ECM control functions, micro controllers for automobile, electro chemical capacitors, electronic stability control, seatbelt sensors, cruise control, electric valve actuators, integrated starter alternator. tyre pressure monitor.

MODULEVI   ACCESSORIES   6

Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, air bag electrical diagram, Horn, Wiper system, Trafficator, wiring system. (Accessories) - Parking assist, Electronic brakes, Power window, automatic lock controls, GPS and Satellite navigation.

Total Hours: 45

TEXT BOOK:

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

   REFERENCES:

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

OUTCOMES:

On completion of the course the students should be able to

- Enumerate the working principle and different types battery used in automobile.
- Demonstrate the principles of operation and constructional details of various Automotive starting system and charging systems.
- Analyze the starting and ignition systems.
- Evaluate the functioning of automotive electrical and electronics components.
- Enumerate modern electronics systems in automotive today
- Demonstrate the various vehicle comfort systems and accessories electrical and electronics.

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   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 learn the behavior of viscosity liquid fuels
- To examine the flash and fire point of fuels
- To examine properties of liquid and gaseous fuel

STUDY EXPERIMENTS:

- Study of International and National standards for fuels and lubricants.

- Study of Octane and Cetane Number of fuels.

LIST OF EXPERIMENTS:

1. Testing of fuels - Ultimate analysis, proximate analysis

2. ASTM distillation test of liquid fuels

3. Aniline Point test of diesel

4. Calorific value of liquid fuel.

5. Calorific value of gaseous fuel.

6. Reid vapour pressure test.

7. Flash and Fire points of petrol and diesel.

8. Copper strip Corrosion Test

9. Cloud & Pour point Test.

10. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.

11. Viscosity Index of lubricants & Fuels by Saybolt Viscometer

12. Ash content and Carbon Residue Test

13. Drop point of grease and mechanical penetration in grease.

Total Hours: 45

OUTCOMES:

After completion of this course the students should be able to

- Analyze the viscosity, flash point, fire point and Reid vapour pressure of liquid fuel.

- Determine calorific value of liquid and gaseous fuel.

- Analyze of cloud and pour point of liquid fuel and copper strip corrosion.

- Determine the aniline point of given liquid fuel.

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

OBJECTIVES:

- T o study the working principle of the various electrical and electronic control devices used in automobile.

STUDY EXPERIMENTS:

- Study of revolution counter circuit

- Study of control of DC motors

- Study of IC 555 timer for motor control

LIST OF EXPERIMENTS:

1. Verify logic gates (AND,OR, NAND, NOR, EX-OR)

2. Lab VIEW basic programming (tank level control)

3. Implementation of half adder and full adder

4. Characteristics of Silicon controlled rectifier (SCR)

5. Addition and Multiplication of 8 bit numbers using 8085

6. Stepper motor control using 8051.

7. Temperature monitoring using Lab VIEW

8. Heating and ventilation control using Lab VIEW.

Total Hours: 45

OUTCOME:

On completion of the course students should be able to

- Demonstrate the working of various electronic and control devices used in automobiles

- Design simple electronic circuits for automotive applications

- Design stepper motor actuation for automotive applications

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.

STUDY EXPERIMENT:

• Study and demonstrate the function of each component of different type of front axles with hub.

LIST OF EXPERIMENTS:

1. Identification and measurement of various types of frames and its cross sections.

2. Evaluate steering geometry practically by eye vision also find steering ratio.

3. Find out the angle of outside lock of front wheel and true turning circle radius.

4. Evaluate the function of different types of clutches and torque converter.

5. Evaluate the function of different types of gear boxes and determine the gear ratios for each speed.

6. Evaluate the function of propeller shaft with universal joint and also find the angle of universal joint.

7. Evaluate the function of the final drive, differential and also find the final reduction and wheel reduction.

8. Evaluate the function of the different types of wheels and tyres also measure the various parameters of wheels and tyres.

9. Identify the function of each components of front and rear suspension system also find the deflection of springs.

10. Evaluate manual and power assisted steering mechanism.

11. Examine practically different types of braking system and adjust the free play.

OUTCOME:

On Completion of the course students should be able to:

- Demonstrate the working of steering system
- Evaluate different types of brake system
- Evaluate different types of transmission system
- Evaluate different types of suspension system
- Evaluate different types of drive line system
- Evaluate different types of wheels and tyres

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 of automotive components

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:

On Completion of the course students should be able to

- Create three dimensional tyre model using basic concepts
- Develop vehicle design mechanisms and various Auto body panels
- Generate mathematical model and analyse the performance characteristics of Suspension model using MATLAB/ Simulink.
- Analyze the propeller shaft and final drive under various load conditions
- Discuss the drive train dynamics and devise Finite Element analysis (FEA) under vibration and failure condition.
- Create Individual vehicle design report.

SEMESTER VII

		L T P C
AUB4101	**VEHICLE DYNAMICS**	**3 1 0 4**

OBJECTIVE:

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

MODULE I   VIBRATION BASICS   8

Fundamentals of vibration, Sources of vibration, single degree of freedom, two degree of freedom, multidegree freedom, free, forced and damped vibrations, magnification factor, transmissibility.

MODULE II   VERTICAL DYNAMICS   11

Design, analysis of passive, semi active and active suspension, Influence of suspension stiffness, suspension damping, and tyre stiffness. Pneumatic suspension system.

MODULE III LONGITUDINAL DYNAMICS   11

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. Over steer, under steer, effect of braking.

MODULE IV LATERAL DYNAMICS   11

Steady state handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Effect of suspension on cornering.

MODULE V WHEELS AND TYRES   10

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

MODULE VI DYNAMIC VEHICLE CONTROL TECHNIQUES   9

Suspension Control techniques. Anti lock braking control, stability control, Traction control, Bicycle Model, cruise control.

Total Hours: 60

TEXT BOOKS:

1. Singiresu S. Rao, Mechanical Vibrations (5th Edition), Prentice Hall, 2010

2. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.

3. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley

4. J. Y. Wong, Theory of Ground Vehicles, 3rd Edition, Wiley-Interscience, 2001

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:

On Completion of the course students should be able to

*   Develop the fundament concepts to analyses the vehicle system performance in dynamic condition
*   Generate mathematical model and analyze the performance characteristics of Suspension
*   Analyse the performance at different surfaces like curved track, slope and a banked road.
*   Discuss the handling characteristics and Transient response characteristic associate with the effect of suspension on cornering.
*   Demonstrate characteristics   wheels and tyre dynamics control systems.
*   Discuss modern control methods to develop vehicles for modern scenario.

AUB 4102	AUTOMOTIVE TRANSMISSION	L T P C
		3 1 0 4

OBJECTIVES:

- To understand about the various components in transmission system and drive line units of automobiles.

- To understand about the working principle of transmission system and hydrodynamic transmission.

- To understand about the various automatic transmission systems in a vehicle.

- To understand the applications of automatic transmission in a vehicle.

- To understand about the hydrostatic drive principle and working of electric drive in a vehicle..

MODULE I CLUTCH AND GEAR BOX   10

Requirement of transmission system, Different types of clutches, principle & Construction of Single plate and multiplate clutch, centrifugal clutch.
Need and Objectives of Gear box. Construction and operation of Sliding mesh, Constant mesh and Synchromesh gearboxes – Determination of gear ratios for vehicles

MODULE II HYDRODYNAMIC TRANSMISSION   10

Fluid coupling-working principle and Constructional details, Torque capacity and Performance characteristics. Reduction of drag torque in fluid coupling. Torque converter-working principle and constructional details, performance characteristics.

MODULE III EPICYCLIC GEARBOXES   10

Requirements of Epicycle gear system, Epicycle gearbox working and operation and Constructional details. Principle of Planetary gear trains - Wilson Gear box, Hydraulic Control system for Automatic Transmission.

MODULE IV AUTOMATIC TRANSMISSION APPLICATIONS   10

Need for automatic transmission, Chevrolet "Turboglide" Transmission, Continuously Variable Transmission (CVT) – Types and Operations of a typical CVT and applications.

MODULE V HYDROSTATIC TRANSMISSION   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.

MODULE VI ELECTRIC DRIVE   10

Electric drive, layout of electric drive, types- Principle of early and modified Ward Leonard Control system-Advantages & limitations. Comparison of early and modified ward Leonard control system. Hybrid vehicle, fuel cell powered vehicle and solar powered vehicle.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Heldt, P.M., "Torque converters", Chilton Book Co., 1962.

2. Newton and Steeds, "Motor vehicles", Illiffe Publishers, 1985.

3. Devaradjane. Dr. G., Kumaresan. Dr. M., "Automobile Engineering", AMK Publishers, 2013.

4. A Text book of Auto Transmission and Electrical systems by K.S Raghu Ram.

5. Automotive Transmissions Fundamentals, Selection, Design and Application- 2011. Naunheimer, H., Bertsche, B., Ryborz, J., Novak, W.

REFERENCES:

1. SAE Transactions 900550 & 930910.
2. Hydrostatic transmissions for vehicle applications, I Mech E Conference, 1981- 88.
3. Crouse,W.H., Anglin,D.L.," Automotive Transmission and Power Trains construction", McGraw Hill, 1976.
4. Heinz Heisler, "Advance vehicle Technology", Butterworth-Heinemann, 2002

OUTCOMES:

On completion of the course students should be able to

- Analyze the constructional and working principle of various types of clutch and gearbox.

- Evaluate the various types of automatic transmission used in automobile vehicle.

- Calculate the gear ratio for the epicyclical gear train and gear boxes

- Analyze various types of transmission used in automobile vehicle.

- Demonstrate construction and working principle of hydrostatic, hydrodynamic transmission.

- Analyze the merits of electric drive used in a vehicle.

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

OBJECTIVES

- To understand the principle of electronic engine management systems.
- To know the location and working of various sensors and actuators.
- To have an understanding about the management SI and CI engines.
- To understand about engine pollutant formation and effects.
- To know about the control of emission in SI and CI engines.
- To have knowledge about emission test procedures, norms, cycles ang measuring instruments.

MODULE I   FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS   6

Components for electronic engine management system, open and closed loop control   strategies, PID control, 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   8

Sensors for 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 , actuators, various types of actuators.

MODULE III   MANAGEMENT OF SI AND CI ENGINES   9

Layout and working of SI engine management systems. Group and sequential injection techniques. TBI, MPFI and GDI systems. electronic ignition system, Electronic spark timing control. Diesel injection, Pilot, main, advanced post injection and retarded post injection techniques .

Electronically controlled Unit Injection system. Layout of the common rail fuel injection system.

MODULE IV   CI EFFECTS AND FORMATION OF POLLUTANTS   6

Emission from automobiles, transient emission, effect of pollutants, global warming, formation of pollutants in SI engines, formation of pollutants in CI engines. Noise pollution and control.

MODULE V   CONTROL OF EMISSIONS FROM SI AND CI ENGINES   8

Design and operating variables, in-cylinder emission control techniques such as ignition timing, air injection, injection timing, water injection, ammonia injection EGR, engine out emission control techniques, PCV system, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, Two stroke engine pollution control.

MODULE VI   EMISSION MEASUREMENT   8

NDIR, FID, Chemiluminescent analyzers, Gas hromatograph, smoke meters, emission standards, driving cycles – USA, Japan, Euro and India. Test procedures, SHED Test, chassis dynamometers, dilution tunnels, sound level meter.

TEXT BOOKS

1. Tom Weather Jr and Cland C.Hunter, "Automotive Computers and   Control System", Prentice Hall Inc., New Jersey, 1984.

2. William B.Ribbens Butterworth, Heinemann,"Understanding   Automotive Electronics", 5th Edition, 1998.

3. Jeff Hartman, "How to tune and Modify Automotive Engine Management System"Motor books, 2013.

4. Ganesan.V., "Internal Combustion Engines", Tata McGraw-Hill Publishing Co.,New Delhi, 2003.

5. M.L.Mathur and R.P.Sharma, "A course in Internal combustion engines",Dhanpat Rai & Sons Publications, New Delhi, 2001**.**

REFERENCES

1. Robert Bosch ,"Diesel Engine Management", Wiley Publications, 2006
2. Robert Bosch , "Gasoline Engine Management", Wiley Publications, 2006
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. John B.Heywood, "Internal Combustion Engine Fundamental", McGraw-Hill, 1988**.**

OUTCOMES:

On completion of the course the students should be able to,

* Analyze the requirement and components of engine management system.
* Identify various sensors in EMS and link the actuators.
* Select sensors for ignition and injection system with justification
* Demonstrate the effect of pollutants and find means to reduce the effect.
* Analyze design and operating parameters on emission and select suitable control

devices.

- Select the driving cycles and measurements for the requirement

AUB4104   VEHICLE MAINTENANCE LABORATORY   L T P   C
                                                        0   0 3 2

OBJECTIVES:

- To study the various maintenance the reconditioning of vehicle parts.
- To train the structures in identifying the fault and rectification.
- To impart the fundamental knowledge in evaluation and maintenance.
- To know about the various methods of maintaining vehicles and their subsystems.

STUDY EXPERIMENTS:

- Study and layout of an automobile repair, service and maintenance shop.
- Safety aspects with respect to man, machine and tools.
- General procedures for servicing and maintenance schedule.
- Fault diagnosis and service of transmission system
- Fault diagnosis and service of Electrical system like battery, starting system,
- charging system, lighting system etc.
- Fault diagnosis and service of vehicle air conditioning system

LIST OF EXPERIMENTS:

1. Minor and major tune up of gasoline and diesel engines.

2. Calibration of Fuel injection pump.

3. Cylinder reboring - checking the cylinder bore, Setting the tool and reboring.

4. Calibration of fuel injection nozzle and tester

5. Removal and fitting of tire and tube.

6. Fault diagnosis of ignition system and spark plug cleaner & tester

7. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.

8. Wheel alignment procedure for servicing and maintenance.

9. Fault diagnosis of brake/clutch

10. Calibration of head lamp aligner

11. Calibration of Refacer of valve.

TEXT BOOK:

1. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal, Jayesh P.Maniar. 2014

2. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFRENCES:

1. Vehicle Service Manuals of reputed manufacturers
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. <u>Nissan Patrol Automotive Repair Manual: 1998-2014</u> by Haynes Manuals Inc.

4. Automobile electrical manual a comprehensive guide by Haynes manual car repair

OUTCOMES:

On completion of the course the students should be able to

- Identify the analyze faults in a vehicle.
- Demonstrate the procedure for reconditioning and repairing of various component and subsystems of vehicles.
- Illustrate the complete methodology of evaluation and maintenance of automobile.
- Perform dismantling & assembling of automobile components using tools.
- Enumerate the importance of maintenance and also the step by step procedure for maintaining the various automotive subsystems.

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

OBJECTIVES :

- To familiarize the various mechanisms available in the, milling ,gear hobbing and grinding machines.

- To know the various tools and work holding devices used in machining processes

- To practice the basic machining operations performed in the special purpose machines

- To have knowledge about product manufacturing phases and experience working in teams to manufacture a product.

- To know the application of various CNC 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:

On completion of the course, students should be able to:

- Select suitable machining operations for automobile components.
- Equip with good practical knowledge required in the core industry.
- Write the CNC program for particular machining operations.
- Compute the various operations in the CNC machine.
- Interpret the different machining process using different techniques.
- Apply and analyze the machining operations performed in the special purpose machines

AUB4106	ENGINE TESTING AND EMISSION LAB	L T P	C
		0 0 3	1

OBJECTIVES

• To learn the various performance characteristics of both petrol and diesel engines

• To learn the various constituents of exhaust emission.

LIST OF EXPERIMENTS:

1. Performance study of petrol engine at full throttle and part throttle conditions.

2. Performance study of diesel engine both at full load and part load conditions.

3. Performance study of constant speed twin cylinder diesel engine

4. Morse test on petrol and diesel engines.

5. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.

6. Head balance test on a Automotive diesel engine.

7. Engine tuning for performance improvement.

8. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer for SI engines

9. Diesel smoke measurement for CI engine

10. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer for CI engine

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:

On completion of the course student should be able to

- Analyze the engine performance of given diesel and petrol engine.
- Analyze the friction loss of given IC engine.
- Measure the heat apportion of given IC engine.
- Analyze the petrol and diesel emission with suitable instruments

 .

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　　**L T P C**
　　　　　　　　　　　APPLICATIONS　　　　　　**3 0 0 3**

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   7

Basic concepts of finite element method. Review of various approximate methods in structural analysis, Stiffness and flexibility matrices for simple cases. Direct stiffness method- plane truss idealization, joint forces and displacements. Formulation of governing equations and convergence criteria.

MODULE II   DISCRETE ELEMENTS   7

Use of bar and beam elements in structural analysis. Computer implementation of procedure for these elements. 1D problems with second order equations, weak formulations-Examples from solid mechanics and heat transfer.

MODULE III   CONTINUM ELEMENTS   7

Classification of C0 C1 continuous problems, parameter functions and its properties – completeness and compatibility condition. 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 ELEMENTS   8

Isoparametric quadrilateral elements-Shape functions for rectangular elements, Isoparametric mapping for quadrilateral elements, Numerical integration for quadrilateral elements, Four node quadrilateral element for 2DBVP,Eight node serendipity element for 2D BVP

MODULE V FEA IN THERMAL ANALYSIS   8

Finite element analysis of 2D steady state thermal analysis-Galerkin approach-General two dimensional heat conduction-Axisymmetric heat conduction-Triangular, Quadrilateral elements-Simple problems using three noded triangular only.

MODULE VI FEA IN STRUCTURAL ANALYSIS   8

Finite element analysis of plane elasticity 2D problems-Introduction to theory of elasticity-plane stress-plane strain and Axisymmetric formulation-Element matrices using energy approach-Simple problems using three noded triangular element only.

Total Hours : 45

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:

On completion of the course the students should be able to

- Apply the numerical methods involved in Finite Element basics of truss, beam, membrane, plate, and continuum elements
- Create of planar one-dimensional (truss and beam) elements having linear, quadratic, and cubic shape functions
- Develop the Global, local, and natural coordinates for analysis.
- Generation of planar, plane stress two-dimensional elements (rectangular and quadratic quadrilateral elements)
- Devise of 3-dimensional elements (four-node tetrahedral and eight-node brick elements)
- Compile the formulation and basic energy and weighted residual formulation of finite elements

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

OBJECTIVES:

- To gather knowledge about mathematical modelling technique adopted for different vehicle systems.
- To learn various modelling software and its application in automobile.
- To learn the modelling and simulation technique applies in Automobile.
- To gain knowledge of the different types of simulation software's automotive application and application of FEA techniques related to automobile

MODULE I   COMPUTER FUNDAMENTALS AND TYRE   8

Introduction, Computer fundamentals, An overview of CAD and analysis. Introduction to the modelling and simulation methods of vehicle systems-Fundamental of tyre principles, Vehicle tyre performances in various surfaces, Cornering characteristics of vehicle, Introduction working model two dimensional tyre model.

MODULE II   COMPUTER DRAFTING AND MODELLING   7

Fundamental of 2D and 3D drafting. Introduction - 3D geometry - Surface types - Conventions - Attributes - Geometry - Examples of surface modelling - Solid modelling. Vehicle Kinematics, Multi body vehicle system design, Introduction to 3D vehicle design- Mechanisms-various Auto body panels, Introduction to Nastran2D, Nastran4D.

MODULE III   VEHICLE FRAME AND STEERING SYSTEMS   7

Vehicle Frame **-** loads, moments and stresses on frame members - 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, Steering Mechanisms, steering mechanisms design and analysis.

MODULE IV   SUSPENSION AND FRONT AXLE   7

Suspension computer models & simulations using MATLAB/Simulink, Fundamental concepts of vehicle vibrations principle. Bumper design computer model - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings.

MODULE V   CLUTCH AND GEAR BOX   8

Torque capacity of clutch, design of four speed gear boxes. Drive train model, computer modelling using MATLAB/Simulink-Analysis of loads

MODULE VI   CRASH AND READ AXLE   8

Vehicle Collision analysis, Fundamental law of motion, energy and momentum forces and moments 2D and 3D computer models for calculation of impact forces. Computer aided design of propeller shaft. Modelling of final drive. Roll overs analysis,Modelling and analysis of axles. Introduction to the ADAMS vehicle design software. Finite Element modelling (FEA) and failure analysis stress. Deformation calculation.

Total Hours: 45

Term work
- ❖ Two and three dimensional tyre model
- ❖ 3D vehicle design mechanisms, various Auto body panels
- ❖ Suspension model and simulations using MATLAB/Simulink
- ❖ Computer aided design of propeller shaft and final drive gearing.
- ❖ Finite Element modelling(FEA) and failure analysis
- ❖ Individual vehicle design project.

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. Ramamurthi.V., "Computer Aided Design in Mechanical Engg"., Tata McGraw Hill, New Delhi, 1987.
7. Naim A Kheir system modeling and computer simulation Marcel Dekker Inc 1996
8. Hatmut Bossel Modeling and simulation Volume 1
9. Michael Blundell,Damian Harty –The multibody systems approach to vehicle dynamics Elsevier 2004
10. Gui Rong Liu S S Quek The finite element method:A Practicalcourse Butterworth Heinemann 2003

OUTCOME:

On completion of the course students should be able to

- Identify the fundamental the modelling and simulation methods of vehicle systems.
- Apply the concepts and create two and three dimensional tyre models.
- Design the vehicle frame and steering systems by recall the basic concept
- Develop mathematical model and analyse the performance characteristics of Suspension model using MATLAB/ Simulink.
- Generate the mathematical model and estimate clutch and transmission performances
- Assess the crashworthiness performance of vehicle body associate with FEA techniques

B.Tech. Automobile Engineering

AUBX04   EVALUATION OF VEHICLE PERFORMANCE   L   T   P   C
**   3   0   0   3**

OBJECTIVES:

- To understand the minimum power requirement for vehicle propulsion and significance of aerodynamic drag forces related to vehicle performance.
- To acquire knowledge about the transmission and engine system performance analysis for ground vehicles.
- To expose the modern control system evaluation for engine, steering, suspension and brake systems.
- To provide knowledge about various types of testing methods used for validating the vehicle design.

MODULE I   VEHICLE PERFORMANCE   7

Vehicle performance estimation and prediction, Aerodynamic drag, methods of estimation of resistance to motion, power requirement for propulsion, Power plant characteristics & transmission related requirements, vehicle acceleration, maximum speed, and gradiability drive systems comparison.

MODULE II   VEHICLE TRANSMISSION   7

Vehicle Transmission performance: Characteristics and features of friction clutches, mechanical gear transmission and Epicyclic gear boxes, fluid coupling & torque converters. Transmission efficiency measurement

MODULE III   ENGINE PERFORMANCE   7

Operational performance: Engine performance and operating characteristics at full load and part load condition, fuel economy, effect of vehicle condition, tire and road condition, traffic condition and driving habits on fuel economy.

MODULE IV   VEHICLE SYSTEM CONTROL   8

Different Vehicle Control Systems, Braking arrangements and characteristics, weight transfer, steering arrangements, rigid & independent suspension, roll centre, torsion bar, stabilizer, and radius bar. Drive by wire technology, vehicle safety systems

MODULE V   TESTING AND VALIDATION   8

Vehicle performance Testing: Laboratory testing – Testing of major components of vehicle like clutch, suspension, braking, steering etc., Engine testing- noise vibrations, emission, power &fuel consumption, brake testing on the road.

MODULE VI   VEHICLE TESTING   8

Vehicle testing on chassis dynamometers, Road and Track testing, Initial inspection, running in and durability, extensive driving, maximum speed & acceleration, handling and ride characteristics on different road surfaces, ride comfort, corrosion testing.

TERM WORKS

- ➢ Estimation of power requirement for vehicle propulsion considering Aero dynamic describe the ride characteristics for different road surfaces. Also compute maximum acceleration with respect to speed
- ➢ Analyse the performance and characteristic of transmission system for different friction values
- ➢ Engine testing for finding the performance characterises and on road fuel consumption measurement
- ➢ Brake Efficiency measurement and Noise and vibration measurement in passenger compartment
- ➢ Study of chassis dynamometer for vehicle performance testing and study of vehicle component testing

Case Studies

➢ Study the Automatic Transmission system performances for different speed and Load conditions
➢ Study the engine performance characterises for various load and speed condition
➢ Evaluation human ride comfort characteristics for ISO class A to Class E road surfaces

Total Hours : 45

REFERENCES

1. Gousha H.M., "Engine performance diagnosis & Tune up shop manual"
2. J.G. Giles, "Vehicle Operation & performance".
3. W.H. Crouse & D.L. Anglin, "Motor vehicle inspection".
4. SAE Transactions papers – 831814 / 820346 / 820371 /820375
5. CIRT &VRDE Manuals

OUTCOMES:

On completion of the course the students should be able to

- Estimate the power requirement for vehicle propulsion by considering aero dynamic effects and the ride characteristics analysis for different road surfaces. Also able to compute maximum acceleration with respect to vehicle speed

- Demonstrate basic elements to investigate the performance of transmission system and brake efficiency measurement.
- Analyze the various performance characteristics of Engines
- Analyze the requirements of modern control methods in steering, suspension and braking systems.
- Compute the vehicle subsystem performance characteristics using fundamental concepts
- Validate the vehicle design with vehicle performance testing, component testing in chassis dynamometer. Vibration and Noise measurements in passenger compartment.

AUBX05	AUTOMOTIVE AERODYNAMICS	L T P	C
		3 0 0	3

OBJECTIVES:

- The students able to know study the basics of Automotive Aerodynamics in a automobile vehicle.
- The student shall understand the performance of the automobile vehicle.
- The students able to know the resistance of motion, rolling and grade resistance
- The students shall understand the aerodynamic drag and pressure occurs in an automobile vehicle.
- The students will have good exposure in automotive aerodynamic aspects.
- The students also able to know about the wind tunnel test in a vehicle and behavior of a vehicle.

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

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 ANALYSIS OF 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: 45 PERIODS

TEXT BOOKS

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:

On completion of the course, the students should be able to

- Demonstrate the essential facts, concepts and principles of incompressible flows including vortices and viscous effects, boundary layers, wing and diffuser aerodynamic characteristics.
- Analyze the effects of aerodynamics on motorsport vehicle design and operation.
- Demonstrate 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.
- Analyze the evaluate the low speed aerodynamic characteristics of representative vehicles.
- Enumerate identify the handling characteristics of a vehicle.
- Analyze the components using acquired wind tunnel data, data sheets and fundamental principles.

AUBX06	AUTOMOTIVE SAFETY SYSTEMS	L T P	C
		3 0 0	3

OBJECTIVES:

- The students will have good exposure in automotive safety aspects including the understanding of the various safety equipments.
- The students able to know the design of body for safety, dimensions of a body and about the impact of a vehicle.
- The students also able to know about the safety systems in a vehicle and deformation behavior of a vehicle.

MODULE I   INTRODUCTION   7

Design of the body for safety, energy equation, engine location and vehicle size and structure. Energy-absorbing bumpers, bumper design for safety and vehicle seating positions.

MODULE II   VEHICLE SAFETY   8

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

MODULE III SAFETY CONCEPT   7

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 EQUIPMENTS   8

Seat belt, collapsible steering column, tiltable steering wheel system, Air bags, Antilock braking system, Adaptive cruise control system and Stability control systems. Automatic parking system.

MODULE V   COLLISION WARNING AND AVOIDANCE   8

Collision warning system, causes of rear end collision, front and rear vehicle object detection system, Automatic braking system, Lane departure warnings system.

MODULE VI   COMFORT AND CONVENIENCE SYSTEM   7

Steering and mirror adjustment, Central locking system, Tyre pressure control system, Rain sensor system, Environment information system.

Total Hours: 45

TEXT BOOKS

1. Bosch, "Automotive Handbook", 8th Edition, SAE publication, 2011.

2. Powloski. J., "Vehicle Body Engineering", Business books limited, London, 1969.

REFERENCES:

1. Ronald.K.Jurgen, "Automotive Electronics Handbook", Second Edition, McGraw-Hill Inc.,

2. Automotive Safety Handbook *Volume 325 of R: Society of Automotive Engineers by Ulrich Seiffert, Lothar Wech*

OUTCOMES:

On completion of the course the students should be able to

- Analyze how the vehicle's structure absorbs impact in a crash.

- Demonstrate various systems that enhance vehicle safety, passenger Comfort, recent technologies in automobile field etc.

- Identify and locate the most important parts of a vehicle with justification

- Describe the purpose of the fundamental automotive system in   a vehicle.

- Analyze the various safety equipments in a automobile vehicle.

- Identify the comfort system and other essential systems in a vehicle.

AUBX07   **COMBUSTION THERMODYNAMICS AND**   **L T P**   **C**
                            HEAT TRANSFER   **3 0 0**   **3**

OBJECTIVES:

- To Study the Combustion Thermodynamics and Heat Transfer

- To study the normal combustion of SI engine

- To study heat transfer from the engine and miscellaneous 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:

On completion of the course the students should be able to

- Conduct analysis on combustion process of given engine
- Analyze heat apportion of given engine
- Perform photographic analysis of give automobile engines
- Asses the knocking properties of CI engine.
- Perform calculations to evaluate the heat transfer in IC engines.
- Investigate the state variables of combustion and heat flow in IC engines.

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AUBX08	JET ENGINES	L T P	C
		3 0 0	3

OBJECTIVES:

- To understand working principle and operation of aircraft power plant
- To understand various procedure and steps involved in component of gas turbine engine design and its performance characteristics

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:

On completion of the course the students can be able to

- Differentiate various types of gas turbine engines and its performance characteristics

- Carry out the simple performance analysis of subsonic and supersonic inlets

- Do the step by step design procedure of combustion chamber

- solve the basic problems related to nozzle

- Analyze the axle and centrifugal compressors

- Evaluate the starting problems in supersonic inlets and solution methods

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:

On completion of the course students should be able able to:

- Analyze various needs of alternative fuels.

- Select suitable fuels for engines with justification.

- Analyze various types of natural fuels.

- Select suitable various vegetable oils for engines with justification.

- Evaluate different layouts for an electric vehicle.

- Select suitable layout for solar vehicle with justifiacation.

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

OBJECTIVE:

- To acquire knowledge of noise vibration and pollution control used in automobile to follow the emission control and ethical standard
- To understand the process and effect of noise vibration and air pollution
- To acquire knowledge on various pollutant measuring techniques and control methods

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 POLLUTANT FORMATION AND AFTER TREATMENT   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 POLLUTANT MEASUREMENT AND 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:

 On completion of the course the students should be able to

- Deduce the general characteristic equation of different types for vibration systems
- Calculate the natural frequency of the system for both experimental and theoretical approach
- Demonstrate the various measuring methods used for noise and sound
- Analyze the various automobiles noise standard level and control techniques
- Identify and discuss the effects of various pollutants from SI and CI engines
- Evaluate different pollution control methods

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

OBJECTIVES

- To understand the composite materials and its applications in automotive Industry
- To have knowledge about composite structure.
- To understand the various types of composite materials.

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:

On completion of the course, students should be able to:

• Classify the characterization of different composite materials.

• Demonstrate the polymer matrix composite manufacturing processes.

• Identify different metal matrix composites and their productions with justification

• Enumerate the ceramic applications in the composite materials.

• Evaluate the effects of structural parameters on the properties of composite.

• Analyze current automotive applications of composite materials in the industry.

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AUBX12   VEHICLE COMFORT SYSTEM & ERGONOMICS   L T P   C

                                                                    3   0 0 3

OBJECTIVES

- To understand the engineering principles that underpins the design of an automotive vehicle for the comfort of the occupants and other road users.
- To understand the future direction of the design of comfort systems within the automotive engineering sector.
- To appreciate the role and use of comfort systems in automobile engineering.
- To understand the safety systems in a vehicle and deformation behavior of a vehicle.

MODULE I   INTRODUCTION TO AUTOMOTIVE COMFORT SYSTEMS   9

Introduction to automotive comfort systems for both the vehicle occupants and other road users. Driver assistance systems-Traffic jam assist, Road sign assistant, Intelligent headlight control, Remote park assist, Side view assist, Interior comfort systems-Seat and comfort actuation, Window lift and sunroof drives.

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
Driving comfort for a passenger car and commercial vehicle – driving, seating, visibility, man-machine system, Psychological factors – stress and attention of a driver.

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:

On completion of the course students should be able to

- Describe the characteristics and importance of ergonomics in automotive design technology.

- Identify relevant automotive design standards with regard to ergonomics with justification

- Design a vehicle system based on automotive design standards with regard to ergonomics.

- Analyze vehicle design performance related to ergonomic aspect.

- Analyze the various comfort system in a automobile vehicle.

- Identify relevant vehicle ergonomics aspects with justification

AUBX13   TRAFFIC ENGINEERING   L T P   C
                                                                3   0   0 3

OBJECTIVES

- To understand the knowledge of traffic engineering includes traffic survey highway, characteristics and traffic control
- To understand the measure of traffic management and importance motor vehicle act.

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:

On completion of the course the students should be able to

- Describe the various traffic characteristic in India
- Analyze the causes for road accident and its preventive methods
- Summarize Non –urban and urban roads characteristics
- Evaluate the various traffic control devices and traffic signs for roads
- Enumerate the procedure for designing of signal timing
- Analyze the latest motor vehicle act and traffic rules and regulations.

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

OBJECTIVE:

- To introduce the concept of fuel cells used in automobiles
- To understand the performance characteristics of various components used in fuel cell

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

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

MODULE IV FUEL CELL PERFORMANCE   7

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

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:

On completion of the course the students should be able to

- Evaluate locate the operational issues and challenges for all major types of fuel cell.
- Evaluate the significance of hydrogen and automobile application
- Formulate the various components required to build the fuel cell
- Determine the performance characteristics of fuel cell for various parameters
- Compare the various types of liquid hydrogen storage methods
- Enumerate the need of fuel cell with various fuel cycle analysis

AUBX15	SIMULATION OF IC ENGINES	L	T	P	C
		3	0	0	3

OBJECTIVES

•   To learn about the heat of reaction and adiabatic flame temperature.
•   To learn about the constant volume and constant pressure adiabatic combustion.
•   To learn about the progressive combustion and multi zone combustion.
•   To learn new concept engine development.

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:

On completion of the course the students should be able to

- Analyze the heat reaction and combustion product.
- Analyze the adiabatic flame temperature of constant pressure and volume combustion process.
- Analyze the ideal and actual cycle
- Analyze the progressive combustion and multi zone combustion.
- Design a combustion chamber for HCCI, Dual fuel and multi-fuel engines.

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

OBJECTIVE:

- To understand the basic working principle of off road vehicle.
- To know the transmission and power train arrangements of dozers.
- To understand the working process of agricultural tractors.
- To have knowledge about trucks and graders.

MODULE I   CLASSIFICATION AND REQUIREMENTS OF OFF ROAD   8 VEHICLES

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   8

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

MODULE V   SCRAPERS AND GRADERS   8

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

REFRENCES :

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:

On completion of the course students should be able to

- Analyze the various recruitment for off road vehicles.
- Analyze the merits and demerits of different types of land clearing machines
- Analyze the merits and demerits of different types of Bulldozers
- Evaluate different types of mining trucks in off road terrain
- Evaluate different types of scrapers and graders .
- Evaluate different types of shovels and ditchers

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AUBX17	SURFACE ENGINEERING	L T P	C
		3 0 0	3

OBJECTIVES:

- To understand the principle and practice of surface engineering and coating techniques

- To acquire knowledge about hard facing and plating processes.

- To get familiarized about thin film coating techniques.

- To understand the high energy modification processes

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:

On completion of the course students should be able to

- Evaluate various tribology processes.

- Demonstrate the different plating processes.

- Summarize the principles and analyze of key characteristics of technologies used in hard facing processes.

- Evaluate the special diffusion processes.

- Identify various thin film coatings with justification.

- Analyze the high energy modification and special processes.

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

OBJECTIVES

- To have knowledge about importance and significances of material quality in service.
- To understand the impact on component life, customers satisfaction in performance.
- To know the procedure of 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 – coeffic ent 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
2.   "Metallurgy of Failure Analysis" by A K. Das; by McGraw- Hill Professional Publication.

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.

3.   ASM Handbook Vol.11 - Failure Analysis and Prevention, ASM

    International   Publication, 1995.

4.   Automotive Component Failures by A. M. Heyes .

5.   Handbook of Case Histories of Failure Analysis, Vol 1 by C.Uhietal

    Robert

OUTCOMES:

On completion of the course, students should be able to:

- Select the suitable material testing processes with justification
- Identify and analyze the relation between the mechanical properties.
- Evaluate the various mechanical and chemical properties of composites.
- Summarize the characteristics of electrical effects of the material.
- Analyze the material behaviour on thermal and chemical loading.
- Analyze the instrumental techniques employed in material testing.

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:

On completion of the course student should be able to

- Generation of thrust in air-breathing engines and rockets;
- Simple performance analysis of subsonic and supersonic inlets;
- Overall performance calculations of turbojets, turbofans and turboprops;
- Working principle of combustors, afterburners, and exhaust nozzles;
- Working of axial flow compressors and turbines, and an ability to carry out flow and performance calculations for these;
- Working principle of liquid and solid propellant rockets.
- Quasi-one-dimensional flow;

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   7

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   6

Cooling system – Classification – Liquid cooling system – Components,

MODULE V   LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR   8

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

MODULE VI FARM EQUIPMENTS   8

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:

On completion of the course students should be able able to

- Demonstrate various design aspects of tractors.
- Analyze the control techniques of tractors and performance of tractor engines.
- Select suitable cooling system with justification.

- Analyze various types of lubrication and system.
- Evaluate different types of suspension system
- Select suitable layout for tractors with justification

AUBX21	FLEET MANAGEMENT	L T P	C
		3 0 0	3

OBJECTIVE:

- To understand the operation and management of transport organization and fare structure
- To have a fair knowledge about various maintenance and procedure
- To know about spare parts and supply chain management , procedure getting of licence

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 MOTOR VEHICLE REGULATIONS AND REGISTRATION

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

B.Tech. Automobile Engineering

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:

On completion of the course the students should be able to

- Evaluate the importance of supervision and time management in vehicle operation
- Select suitable techniques to reduce break down cost with justification
- Estimate the vehicle expenses and prepare budget
- Sketch the data processing techniques
- Prepare schedule to structure fare for fleet operation
- Evaluate the procedure of getting vehicle registration and driver license

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.
- The students can impart knowledge basic in fundamentals of fluids, hydraulics system and components.
- The students can impart knowledge basic in design of circuits and in accumulators.
- The students can impart knowledge in properties of air, compressors and regulators.
- The students can impart knowledge in pneumatic systems and components.

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 CIRCUIT DESIGN   7

Pneumatic 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 FLUDIC SYSTEMS   7

Fludic systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluids - 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:

- Analyze the merits and demerits the fluid power.

- Analyze different types of fluid power system, and properties of hydraulic fluids and general types of fluids

- Design hydraulic circuits.

- Compare to different pneumatic systems and components

- Design pneumatic circuits

- Select suitable system for different applications.

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

OBJECTIVE:

- The student will have good exposure in basic of computer aided design and Manufacturing.
- The students shall understand the drafting and geometric modeling of database structure for graphics modeling.
- The students shall understand the numerical control, machining center, turning centre And CNC programming.
- The students shall understand the CAD production group technology and production planning.

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:

On completion of the course the students should be able to

- 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.
- Able to classify part families and understand production flow analysis.

- Select the suitable manufacturing principle for particular product development with justification.

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 the course student should be able to

- Explore and apply the principles of TQM in management.
- Demonstrate knowledge of quality management systems, their implementation and the practical steps needed for implementation.
- Select and apply appropriate Specific Process Control (SPC)techniques and evaluate data generated.
- Demonstrate the ability to produce a quality manual product quality management, safety and environmental management.

- Demonstrate the knowledge of auditing and auditing systems.

- Analyse management systems and practises with respect to TQM..

AUBX25   **VEHICLE BODY ENGINEERING**   **L T P C**

                                                           3 0 0 3

OBJECTIVES:

- The students shall understand the construction of car body, design criteria, types of car and safety aspects of car.
- The students will be able to know the construction of bus body and dimensions of bus body and safety aspects.
- The students shall understand the different types of commercial vehicles; design of cab and in aerodynamic testing, forces and moments.
- The students will be well versed in the design and construction of external body of the vehicles and materials used in vehicles.

MODULE I CAR BODY DETAILS   8

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Car body construction; design criteria. Crash tests on full scale model, Dummies and Instrumentation. Safety aspect of car body.

MODULE II BUS BODY DETAILS   8

Types of bus body: based on capacity, distance traveled and based on construction. Bus body lay out for various types, floor height, engine location, entrance and exit location, seating dimensions. Types of metal sections used – Regulations – Constructional details: Conventional and integral.

MODULE III COMMERCIAL VEHICLE DETAILS   7

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body, Drivers cab design - Regulations.

MODULE IV VEHICLE AERODYNAMICS   7

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 tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.

MODULE V BODY MATERIALS   8

Types of materials used in body construction-Steel sheet, timber, plastics, GRP, properties of materials. Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion and Anticorrosion methods.

MODULE VI TRIM MECHANISMS AND BODY REPAIR   7

Modern painting process procedure-paint problems and Body trim items-body mechanisms.

TOTAL: 45

TEXT BOOKS:

 1. Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.

 2. James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 2009.

REFERENCES:

1. Giles, G.J., "Body construction and design", Illiffe Books Butterworth & Co., 1991.

2. John Fenton, "Vehicle Body layout and analysis", Mechanical Engg. Publication Ltd.,

   London, 1992.

 3. Braithwaite, J.B., "Vehicle Body building and drawing", Heinemann Educational

   Books Ltd., London, 1997.

4. Dieler Anselm., The passenger car body, SAE International, 2000

OUTCOMES:

  On completion of the course the students should be able to

- Design car body and identify the car body parts in a vehicle.
- Evaluate different aspects of car body and bus body, types, commercial vehicle.
- Analyze the Role of various aerodynamic forces and moments, measuring instruments.
- Evaluate the different aspects of car body and bus body, types, commercial vehicle.
- Identity the material which can be used in car body, bus body of an automobile vehicle with justification
- Demonstrate the painting process for a commercial vehicle and identify tools used for body repairs.

AUBX26	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:

On completion of the course student should be able to

- Able to locate and describe, the content of ethics with at least one example   of a

   law(state, national, or international)

- Able to apply the content of ethics with at least one example of a law.

   (state, national, or international)

- Able to locate and describe the content of the code of ethics/conduct with at least one professional society.

- Able to apply the content of the code of ethics/conduct of with least one professional society.

- Able to prepare and describe their own personal definition of what makes for an ethical engineer.

- Able to defend their own personal definition of what makes for an ethical engineer.

AUB X27   MODERN AND INTELEGENT VEHICLE SYSTEMS   L T P C
                                                          3 0 0 3

OBJECTIVE:

- To acquire knowledge about the principle of chassis management system
- To learn about different sensors and actuator used in the vehicle.
- To gather knowledge about the modern techniques in the vehicle
- To learn control systems like steering, suspension, and braking system.
- To gain knowledge of the different controls system in vehicle navigation systems.

MODULE I   CHASSIS MANAGEMENT SYSTEM   8

Components of chassis management system – role of various sensors and actuators pertaining to chassis system – working principle of wheel speed sensor, steering position, tyre pressure, brake pressure, steering torque, fuel level sensors.

MODULE II   DRIVELINE CONTROL SYSTEM   7

Speed control – cylinder cut-off technology, Gear shifting control – Traction / braking control, brake by wire – Adaptive cruise control, throttle by wire. Steering - Power steering, collapsible and tiltable steering column – steer by wire.

MODULE III SAFETY AND SECURITY SYSTEM   7

Airbags, seat belt tightening system, collision warning systems, child Lock, anti lock braking systems, Vision enhancement, road recognition system, Anti theft technologies, smart card system, number plate coding, central locking system.

MODULE IV BODY CONTROL SYSTEM   7

        Requirement and characteristics suspension, different types suspension, Vehicle pitch, roll, bounce control, Semi active suspension, Active suspension systems,fully active suspension,power windows, thermal management system, adaptive noise control

MODULE V   INTELLIGENT TRANSPORTATION SYSTEM   9

Traffic routing system - Automated highway systems - Lane warning system – Driver Information system, side blind zone warning system, automatic parking system, driver assistance systems - Radar guide brakes, radar guided lane assist, Global positioning system.Data communication within the car, Driver conditioning warning -Route Guidance and Navigation Systems – vision enhancement system.

MODULE VI MODERN VEHICLE SYSTEMS   7

Integrator starter, Alternator, Starts stop operation, Un man vehicle technology, Regenerative energy recovery, advanced lead acid batteries, alkaline batteries, Lithium batteries, Development of new energy storage systems,Deep discharge and rapid charging, ultra-capacitors. -   In-Vehicle Computing –Vehicle Diagnostics system – Hybrid / Electric and Future Cars – Case studies.

Total Hours: 45

TEXT BOOKS:

1. U. Kiencke, and L. Nielsen,Automotive Control Systems,SAE and Springer-Verlag, 2000.

2. LjuboVlacic, Michel Parent, Fumio Harashima, "Intelligent Vehicle Technologies" ButterworthHeinemann publications, Oxford, 2001.

REFERENCES:

1. Crouse, W.H. & Anglin, D.L., "Automotive Mechanics", Intl. Student edition, 9thedition, TMH, New Delhi, 2002.

2. William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn,1998.

3. Bosch, "Automotive HandBook", 6th edition, SAE, 2004.

OUTCOME:

On completion of the course student should be able to

- Prepare layout of sensors for chassis management system and its control
- Analyse of different sensors and actuators for automotive applications.
- Design suitable transportation systems for requirements.
- Discuss case studies on Research focused areas
- Analyze faults and suggest remedies.
- Learner can able to apply the knowledge to develop future technology cars

AUB X28	MOTORSPORT ENGINEERING	L T P C
		3 0 0 3

OBJECTIVES:

- Understand and identify problem areas in the preparation of a Motorsport vehicle is essential for a Motorsport technician, as is the ability to configure and set up a vehicle in order to achieve its maximum performance with reliability and overall system efficiency.

MODULE I   OVER VIEW OF MOTOR SPORT ENGINEERING   8

Introduction about motor sport vehicles, various types of motor sport vehicles and their requirements, competitions and requirements, Preparing for the competitions, Case studies of completed events., bench marking, project planning, PERT, CPM, FMEA, business plans

MODULE II   POWER TRAIN   8

Engine management systems, sensors, alternative fuels, oxidizing agents, chemical composition of fuels, ignition systems and components.Engine and transmission configurations – front/ rear/mid engine and associated driveline Transmission systems – clutches, torque converters, manual gearbox types, automatic gearbox types, electronic and hydraulic transmission control, traction control, launch control, KERS systems. Final drive systems – differentials, Tor-sen, torque biasing, LSD, Salisbury, air-locking, fluid coupling Hybrid Drive systems.

MODULE III   MATERIALS AND PROCESSES   8

Selection criteria: material properties, including cost drivers, mechanical, physical, chemical and process characteristics. basic properties of materials such as ceramics, metals, composites and polymers. Testing of materials, ISI standards, standard published data sources, engineering drawings Joining techniques including, brazing and welding, effect on structure and properties, use of adhesives.Processing limitations: effects of properties such as structure preventing or facilitating processing techniques. heat treatments of metals and alloys, coatings and other surface treatments, polymer processing.

MODULE IV   FAILURE MECHANISMS   7

Causes of failure: appreciation of failure mechanisms in materials such as metals, ceramics, polymers and composites; such as creep, fatigue, impact, overstressing, corrosion, temperature, thermal cycling, residual stresses, stress relaxation, degradation (composition change), radiation, electrical breakdown.

MODULE V   VEHICLE ELECTRONICS   7

Electronics – semiconductors, electronic circuitry, integrated circuits. ignition systems, Engine management systems, sensors transistorized and capacitor discharge types, fuel injection systems and sensors, ECU programming and mapping., ABS, TRS, active suspension system, Tuned manifloding

MODULE VI   MOTOR VEHICLE CHASSIS   7

Frame design for different vehicles, layout of components, weight distribution, weight transfer and braking requirements, suspension system, steering system, body design and fabrication, driver seat and safety requirements, Electrical systems and wiring, wheels and tires. Testing and validation.

Total Hours: 45

REFERENCES

- Hillier, VAW (2006) Fundamentals of Motor Vehicle TechnologyStanleyThornes

  Davis & Davis (2001) Supercharging, Turbocharging and Nitrous Oxide performance. Motorbooks.

- Marek, J. (2003) Sensors applications: sensors for automotive technology. Wiley
- Walker, D. (2001) Engine management. Haynes
- Staniforth, A (2002)Race and rally car sourcebook Haynes
- Staniforth, A (2006)Competition car suspension Haynes
-             van Valkenburg, P (2001)Race car engineering and

  mechanicsMotorbooks International
- Milliken & Milliken (1997) Vehicle dynamics. SAE .

OUTCOMES

On completion of the course student should be able to

- Design and select suitable frame for different vehicles.

- Select suitable layout of components, based on weight distribution, weight transfer and braking requirements.

- Design suitable transmission, suspension system and steering system.

- Design and fabricate body, driver seat and safety requirements.

- Design of electrical systems and wiring and power train tuning.

- Select suitable wheels and tires.

- Test and validate the vehicle.

MEBX03 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS   L T P   C
**   (Use of approved design data book is permitted)   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   L T P   C
AUTOMOTIVE COMPONENTS   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	L T P	C
	AND SIMULATION	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.

GEB X105	TRANSPORT MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.

- To understand the need of maintenance and its importance.

- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION   7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages,methods of training, training procedure, psychological tests.

MODULE II   ORGANISATION AND MANAGEMENT   7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III   TRANSPORT SYSTEMS   9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV   SCHEDULING AND FARE STRUCTURE   8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V   MOTOR VEHICLE ACT   7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI   MAINTENANCE   7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

TOTAL HOURS: 45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.

2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date

OUTCOMES:

On completion of the course the students should be able to

- Enumerate the need for training and selection processes of personnel
- Prepare the organisation structure chart with functions
- Categorize the various levels of transport system

- Analyze the issues for the creating of vehicle scheduling and fair structure
- Demonstrate motor vehicle act and regulation as applied to automobile vehicles
- Enumerate various types of maintenance to be followed in automobile vehicles

GEBX214 **AUTOMOTIVE POLLUTION AND CONTROL** **L T P C**
3 0 0 3

OBJECTIVE:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I   EMISSION FROM AUTOMOBILES   8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II   SI ENGINE EMISSIONS AND CONTROL   9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor,

MODULE III   CI ENGINE EMISSION AND CONTROL   8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV   NOISE POLLUTION FROM AUTOMOBILES   8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V   TEST PROCEDURES   6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI   EMISSION MEASUREMENTS   6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

Total Hours: 45

TEXT BOOKS
1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.

2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.

2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.

3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.

4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.

5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUT COMES

The student should be able to

- Identify the sources of emission form vehicles.
- Analyze the causes of emissions.
- Bring out solutions for control of emissions.
- Be familiar with test procedures and emission norms

- Select suitable instrument and procedure for measurement of emissions